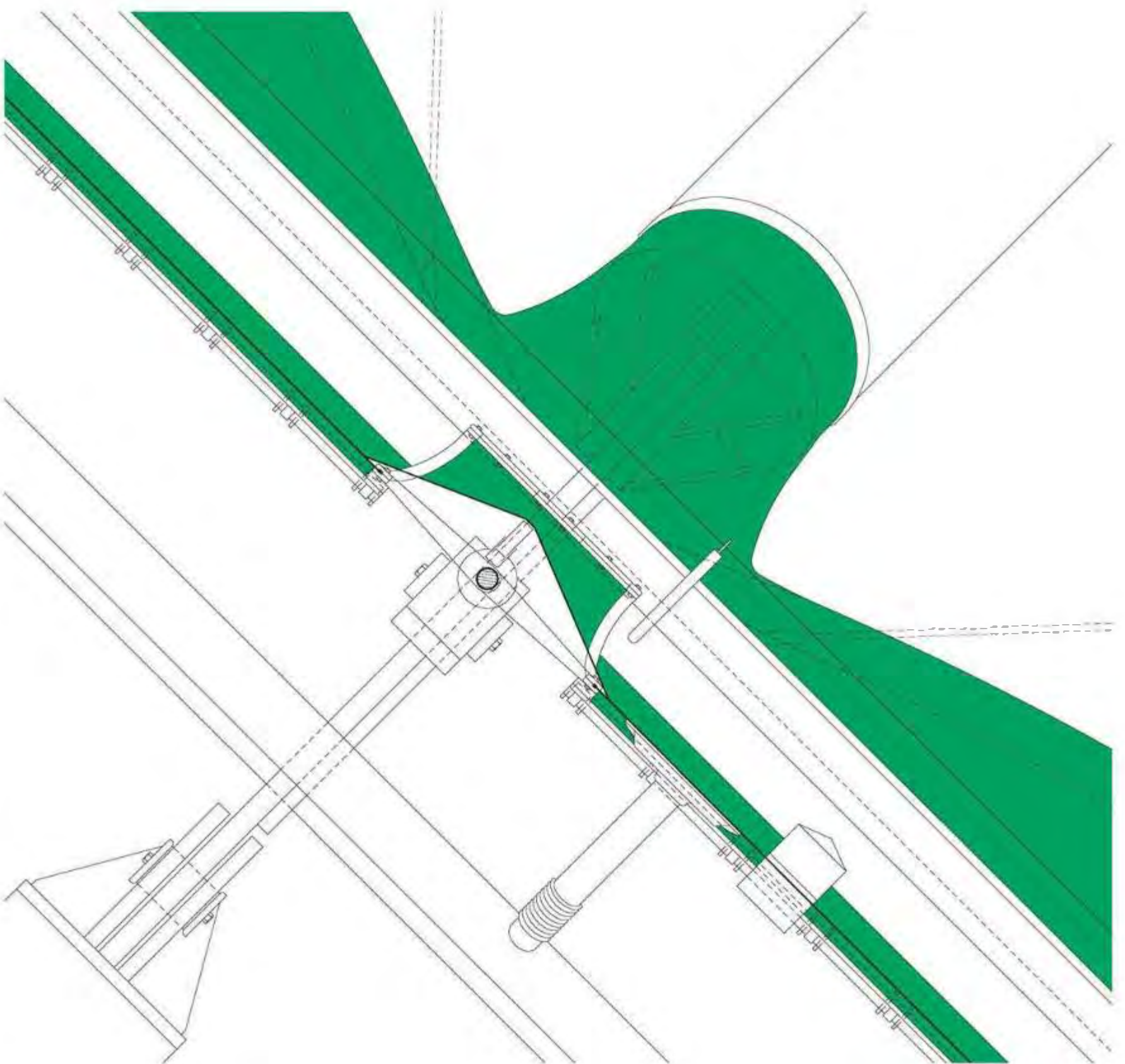


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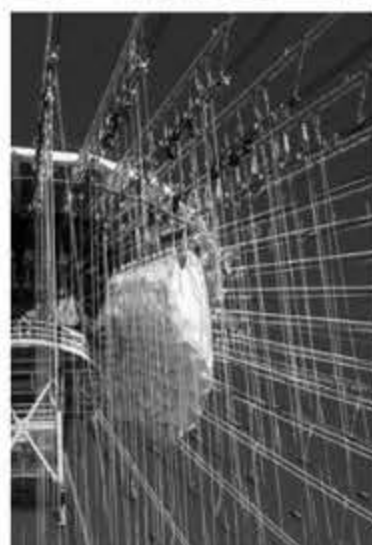
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Editorial

Not every load-bearing structure in this issue of *DETAIL* is as spectacular as that of the new King's Cross Station concourse in London (page 613). What they all have in common, however, is the dominant role they play in the overall concept of each development, whether in determining the design form or in terms of technical refinement. One sees that in the stadium roofs in Warsaw and Kiev (pages 570 and 620), for example, which derive their aesthetic qualities from the logical order of their structures, yet at the same time possess their own individual identity that reflects the needs of the brief and the specific location.

The fact that smaller structures can also pose a challenge technically and in terms of design is demonstrated by a membrane construction created as a student project at the University of Tokyo (page 584). This temporary pavilion has its own specific character, which is experimental and sensuous at the same time. Above all, though, it is distinguished by its extremely lightweight and efficient bearing structure.

In the case of the roof for the new Museum of the Bavarian Kings (page 608), prefabrication played a decisive role. The structure was conceived in such a form that a small number of elements could be constructed and delivered to site for assembly. Here, the architects managed not only to articulate the internal space in an appropriate manner by means of the structure, but to conjure certain associations through the rhomboid-grid ceiling pattern.

The spatial identity of the small library in the Norwegian town of Venesla (page 596) is based largely on its bold load-bearing structure. This consists of laminated-timber arched beams that also house technical installations and incorporate seating and shelving at their lower ends. In contrast, the structure of the new tram depot in Berne (page 602) is designed in such a way that it allows the building to be extended in two further stages without the need for additional columns.

Outstanding developments like those presented in this issue can be achieved only through a collegial cooperation between architects and engineers. The structural planner must be integrated into the design process as a creative partner from the very outset, instead of being called in after the event merely to implement the architect's formal concepts.

Christian Schittich



The Fascination of Stadiums – Architecture and Commerce

An Interview with Volkwin Marg

- 1 Olympic Stadium, Berlin
- 2 National Arena, Bucharest
- 3 Longitudinal section through National Arena, Bucharest
- 4 Olympic Stadium in Kiev

Detail: What is it that fascinates you so much about the construction of stadiums?

Volkwin Marg: Stadiums are the largest places of public assembly that exist. At the same time, they are a mirror of society. For me as an architect, it presents a special challenge to design spaces of this kind, keeping a finger on the pulse of society and being able to apply the boldest, most advanced forms of construction at the same time. That is absolutely fascinating.

Detail: And what do you discover about society in the process?

Volkwin Marg: The complete dictatorship of commerce and consumption comes out

very clearly in the construction of stadiums. Football, for example, is a totally commercialized sport for a class society – the common people at the bottom on plastic seats and the VIPs on upholstered chairs in their boxes. The spectators are not even sifted according to their income, but according to their consumer behaviour. Turbocapitalism scrutinizes people before sorting them into groups in order to bid for their attention in quite specific ways.

Another phenomenon one encounters in building stadiums is the behaviour of the masses on the one hand and the individual people who go to make them up. The masses don't think; they feel.



Detail: Let's take a look at the architecture. The design of a stadium has a lot to do with structural thinking.

Great spans have to be bridged with well ordered load-bearing structures, and the whole has to be lent a significant image.

I imagine that appeals to your attitude towards architecture.

Volkwin Marg: That appeals to me very much. It's a matter of finding a balance between function, construction and significance. For me, architecture is a synthesis of three forms of aesthetic. There's the purely functional aesthetic – as you find with a tool, where the purpose defines the ideal form. The second is the aesthetic of construction:



2

how do I design an ingenious yet logical form that matches the function?

The third component is the aesthetic of significance: how can I indicate the content and the genius loci with the things I construct in a functionally and constructionally optimum manner? Only when a harmonious synthesis is achieved between these three aspects will the architecture be good. That's why no two of our stadiums ever look alike. The cultural and local contexts always differ.

Detail: In the construction of large arenas, the structural engineers play a decisive role, too. How is the collaboration with them?

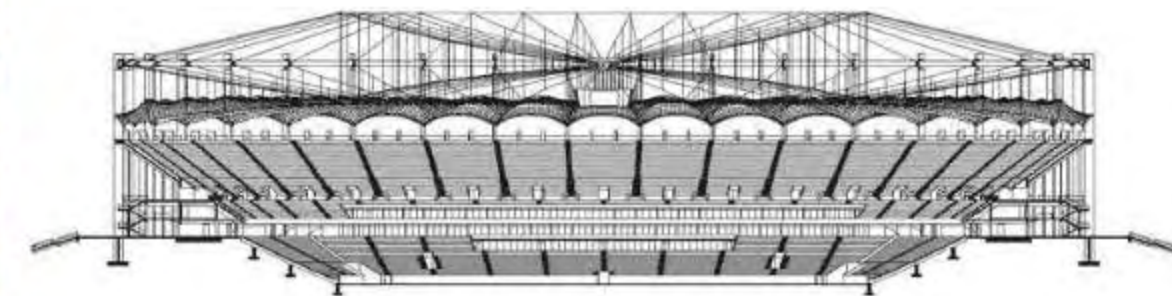
Volkwin Marg: Designing mutually with the engineers, with an office like sbp (Schlaich Bergermann und Partner), is normal practice for us – part of our working style. Architecture is always the outcome of finding and determining forms; and as far as the structure and construction are concerned, engineers who design well are always good at finding forms. In the context of staging or presenting an object, however, some sort of significance will be sought, for which architectural expression is needed. The process of finding forms has to be combined with that of determining forms – in other words, the expression of content and genius loci. In our teams, no one asks who was responsible for a particular idea, and that motivates our engineering colleagues, too. It stimulates their creativity and their openness, and it makes us think in very structural terms all over again.

Detail: How many stadiums have you and your teams designed so far?

Volkwin Marg: We've designed more than 60, but we've actually built a good dozen.

Detail: In other words, you and your teams are perhaps the most successful planners of stadiums in the world at present. How did that come about?

Volkwin Marg: It all began really with the conversion of the Olympic Stadium in Berlin for the 2006 FIFA World Cup in Germany.



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After we had won the competition for that, the stadiums in Frankfurt and Cologne followed.

For the 2010 World Cup in South Africa, we were again successful with three stadiums; and for 2014 in Brazil, we're involved with the arenas in Brasilia and Manaus. For the European Football Championship this summer, we planned Warsaw and Kiev. In addition to these major events, though, we were responsible for various stadiums in other countries. I'm particularly proud of the Romanian National Arena in Bucharest, which we realized at the same time. It resembles a modern Colosseum and reveals a classical harmony in its proportions.

What's more, this completely enclosable stadium is very economical.

Detail: Every one of the stadiums you have mentioned has its own individual face. What's special about Warsaw?

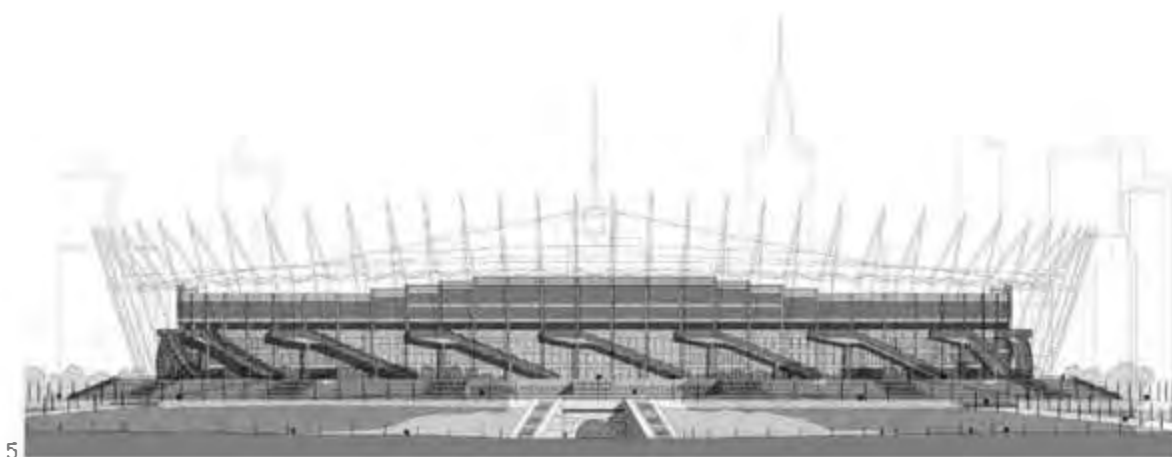
Volkwin Marg: For the European Championships, the Poles summoned their entire pride to present a national stadium that distinguishes itself positively from all the others one has seen hitherto. Self-confidently, it proclaims: "Look! This is the new Poland." It was meant to be a serene structure, also with a roof that could be completely closed. At the same time, superlatives were expected. The membrane roof is capable of



1



4



5, 6 National Stadium in Warsaw
7, 8 Olympic Stadium in Kiev

bearing a total snow load of 800 tonnes in a closed state. Like a radiant crown – in the national colours of red and white – the new arena rises above the earth embankments of the former stands across the Vistula opposite the old city centre. It also stands on historic ground – on precisely the spot where the Poles piled up the debris from the destruction of the city by German bombers – a heap of rubble that followed the Warsaw Uprising of 1944. In other words, the site is steeped in history, fraught with memories that link Germany with the Poles.

Detail: How did you handle the historical aspect?

Volkwin Marg: We didn't touch the existing ruined stadium for 100,000 spectators. We didn't want to dig out gas masks, steel helmets and other relics of those events during excavations. We wanted to leave history in peace. The old stadium dating from the 1940s and 50s thus became the plinth on which our new structure was placed.

Detail: Weren't the Poles sensitive to the fact that German architects, of all people, were building the new national stadium on the ruins of old Warsaw?

Volkwin Marg: Of course there were reservations. We selected a Polish partner office, JSK Architects, and willingly accepted the

fact that they were always mentioned first in Poland among those responsible for the design. This reflection of national pride was not particularly difficult for us to accept.

Detail: How was the task divided between you and the partner office in Warsaw? Did you have assistants working for you locally?

Volkwin Marg: The planning was done by us in Berlin. We took care of the quality control in Warsaw as well. Our Polish partners were responsible for the local execution and site management. They also planned additions where these were necessary.

Detail: And in Kiev?

Volkwin Marg: There we had a so-called "architectural adapter", with the Ukrainian office Y. Serjegin LLC, Kiev, as our local representative. We shared the fee half and half, and the collaboration was excellent.

Detail: On 1 July, a few hundred million people watched the TV transmission of the final of the European Championship from the Kiev Olympic Stadium, which you designed. What sort of feeling was that for the architect?

Volkwin Marg: Oh, the stadium as such hardly makes itself felt on television. Every minute of the transmission is divided between the stations and the organizers according to commercial criteria. You're meant to keep your eyes on the ball and on the advertising at the same time – before and after the match, every second counts. A pan of the camera into the stadium would simply be lost advertising time.

Detail: In other words, the stadium is just a backdrop for television?

Volkwin Marg: Not even that, really. What you see are the masses of people who always look the same basically, but who are meant to conjure an authentic atmosphere.

Detail: Is that why the coloration of the seating is designed the way it is – so that empty rows look animated, too?



Volkwin Marg: That's an additional effect. We used various blue and yellow tones for the seats – the national colours of the Ukraine. From that, we created a kind of camouflage effect.

When people enter the stadium, there's a process of constant change. Different coloured points – red, green and black – are added to the blue and yellow ones. As in a picture puzzle, it's difficult to determine the true colour and the alien colour. In other words, it's not easy to see how empty or full the rows of seats are.

Detail: Did you develop the pattern yourself, or was an artist involved?

The Olympic stadium in Kiev, which served as one of the venues for the football tournament of the Moscow Summer Olympics in 1980, is situated close to the centre of the city of Kiev on historic ground. An earlier sports structure that stood there, known as the Red Stadium Leon Trotsky, which was subject to repeated

alterations and extensions, dated back to the year 1923. Of the arena that immediately preceded the present stadium, the architects adopted mainly the upper stands (ill. 7), dating from 1968 – a finally spun and boldly cantilevered, prestressed concrete structure.

Volkwin Marg: We thought out the system for the World Cup in South Africa in 2010. Any assistant in the office who wanted to could set coloured pixels on the computer like an Impressionist painter. It's the compositional technique known as "pointillism" in the history of art.

Detail: The most striking feature about the Kiev stadium is the roof. When viewed from beneath, it resembles a sky full of stars. How did that come about?

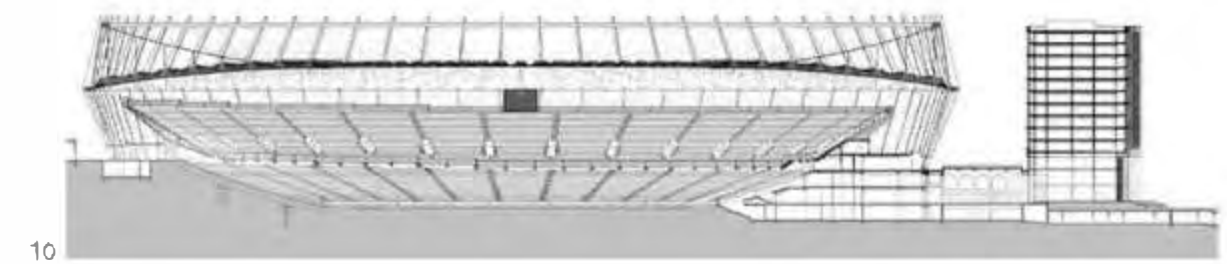
Volkwin Marg: Originally, we wanted to design a roof that was wholly transparent, using a completely clear mesh foil. But this material kept tearing during loading tests,

so that we finally decided to use a conventional membrane spanned over transparent light domes. The dark areas that form the grid of stars, are caused by overlaying a second membrane, which follows precisely the distribution of forces along the lines of the fixings. The design skill lay in defining the right technical conditions for the assembly, so that a constructional aesthetic is created that is self-evident while also allowing various interpretations. When people now say they have the feeling of sitting beneath a sky full of stars, then I'm very pleased. But they could just as easily say: "I feel like a beetle sitting under sunflowers." People create their own metaphors.





9–11 Olympic Stadium in Kiev;
longitudinal section through
internal space



Detail: Then you don't regret that you weren't able to implement your original idea of a completely transparent roof?

Volkwin Marg: No, I don't regret it, especially because we shall soon be building a stadium with a transparent roof – in Chorzów, Poland. There, we're using three-layers of transparent sheeting.

*Detail: Is sunshading not a problem for a dis-
solved roof area, in view of the very hot cli-
mate in summer here in Kiev?*

Volkwin Marg: The answer to that is quite simple: sporting events have long taken their leave of daylight. Daylight cannot be manipulated. Events today are dominated by artificial light and therefore take place at dusk and in the evening. You find the same phenomenon with shopping centres and trade-fair structures.

Detail: Why did you want a transparent roof, then, if everything's likely to take place under conditions of darkness?

Volkwin Marg: Because of the sky by day, but above all because of the effect when seen from the outside. At night, there's a tremendous concentration of light, so that when this stadium is in operation, it radiates so strongly into the sky that it can be seen from far away. One might almost think an UFO had landed with creatures from outer space. There's something fascinating about it.

Detail: Let's consider the local situation. What does it actually mean to build in Ukraine?

Volkwin Marg: The chaotic structures in this country and the constantly changing partners in discussion were not simple for us. On the client's side, we rarely had a proper representative with whom to deal. Our discussion partners changed; no decisions were taken; or a new minister bustled around, and decisions that had already been made were changed at random. Another problem was a building economy that was similar in a way – chaotically improvised. Technologically speaking, Ukraine

is a highly developed nation, with an advanced steel industry. It was poor coordination rather than any lack of ability. This chaos was most blatantly felt in the field of working safety. In Kiev, there were unfortunately more site accidents than with all three of our African stadiums put together.

Detail: And then you find yourself between various political stools?

Volkwin Marg: Of course, one falls quickly between stools as an architect. We were awarded our contract for the stadium in Kiev at the time of the Orange Revolution. We built it during the government of Yulia Ty-

moshenko. Later, the government changed, and we had to come to terms with the next oligarchy. The finished stadium was inaugurated by the new ruler, Viktor Yanukovich. But architecture is a public, political process that usually has a history extending over decades, sometimes a century or more, and it often bridges various forms of government. It can happen, as in our case, for example, that one begins with a pro-Western oligarchy that observes parliamentary rules for at least part of the time, only to have to deal later on with a Mafia-like economic system that does not recognize our rule of law. It's quite possible, though, that in another half year everything will change completely again.





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Detail: In Germany, in the period leading up to the European Football Championship, there was not just talk of boycotting the games in Ukraine. The question was also raised to what extent an architect may build for dictatorial systems.

You and your office not only designed the Olympic Stadium here in Kiev; last spring, you also completed the hall for the Eurovision Song Contest. What's more, you are very active in China.

Volkwin Marg: In addition to various sports stadiums in China, we have built a number of opera houses and theatres, as well as three museums, one of them at Tiananmen Square in Beijing. We have been heatedly criti-

cized for that – and by the same people who import masses of goods from China or do other business there without the slightest compunction. That's a bit schizophrenic, I think. Otherwise, I'm utterly convinced that one simply strengthens the powers that be through isolation. Hitherto, almost every political opening in a country with a suppressive system has been achieved through trade, tourism and modern communication technology. Complete isolation is scarcely possible nowadays. The more exchange there is – in the fields of sport and culture as well – the more difficult it becomes for the powers that be to confine the population in a dictatorial manner. We saw that in the case

of German division, where a readiness to talk and make exchanges ultimately led to an opening and to the overthrow of the GDR regime.

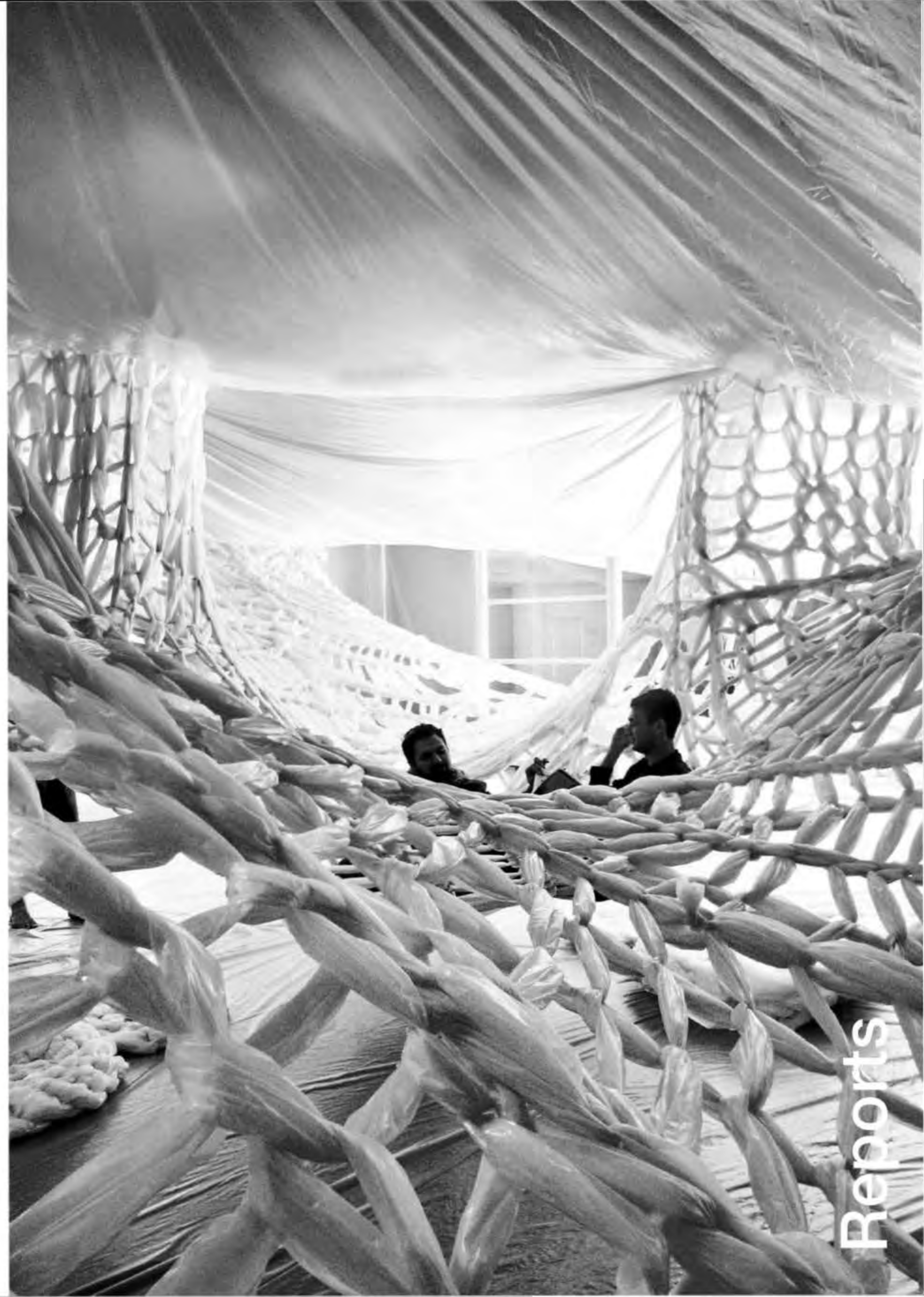
Detail: Thank you for this interview, Volkwin Marg.

12 Arena da Amazônia, Manaus, Brazil
13 Estádio Nacional Brasília, Brazil

Volkwin Marg was interviewed by Christian Schittich in Kiev.



13



Structures for Pleasure

Heide Wessely

Nowadays, architects and structural planners work much more closely and collegially together than they did 15 or so years ago, and the mutual lack of understanding that existed then – to the point of antipathy – has virtually disappeared. This can be attributed largely to the fact that at many universities architectural students have the opportunity of experimenting with load-bearing structures and gaining insights by using them. The results are not just installations or follies, but wholly functional objects, like a project developed at the California Polytechnic State University (ills. 1, 2). For the presentation of their work in book form, the students wanted to create a com-

fortable environment for extensive browsing. They soon agreed upon a suspended structure where they could recline and spend their time comfortably. After trials with cables and fabric strips, they finally agreed on the use of plastic sheeting because this was reasonable in price, light in weight, capable of bearing loads and also simple to work. After they had cut the sheeting into strips, the students built weaving looms to create regular sleeve-like and planar networks. The upper closure of the sleeves is formed by rings made from steel rods, which serve at the same time as a means of suspension at those points where the load-bearing structure of the space permits. The nets were fi-

nally woven in between the sleeves and fixed to each other. This warm resting place, adaptable in form and capable of bearing the requisite loads, is used by students and visitors alike not just for reading purposes, but also as a lounge and meeting point. A summer pavilion in Helsinki, this year's design capital, serves a similar purpose (ills. 3, 4). The building was erected on an area otherwise used as a car park and was the outcome of a student competition at the Aalto University. The load-bearing structure was built with 18 mm sheets of plywood. The radial-section columns stand on steel plates that are bedded on gravel. Each finger of the columns consists of two layers with an intermediate square timber. The whole is rigidly connected with long bolts. The columns broaden towards the top to bear the roof structure, which is in a similar form of construction and has a hexagonal layout. Here, however the plywood sheets are adhesive fixed to the square timbers. The secondary construction consists of only one layer of vertical plywood sheeting. The roof is covered with transparent polycarbonate slabs that allow the entry of daylight, so that a play of light and shade is conjured on the floor and columns. A stage and a sales stand for snacks were created with plywood elements triangular on plan. Unfortunately, the structure was not designed to bear the snow loads of a Finnish winter, so that it was dismantled at the end of September. Whether it will be re-erected next summer or the individual components will be sold and recycled is still not certain.

It was clear from the very outset that Barkow Leibinger's translucent textile roof for the Moroccan biennial of art would stand for only three weeks (ills. 5, 6). For the exhibition – held for the fourth time this year – the architects were commissioned to design an installation for the ruins near the Koutoubia Mosque. Using 3D software, they developed a roof structure, the hyperbolic geometry of which was to be implemented with a display of Moroccan craftsmanship. Based on a 5 x 5 metre grid, simple tubular-steel terminal sockets were welded together to form



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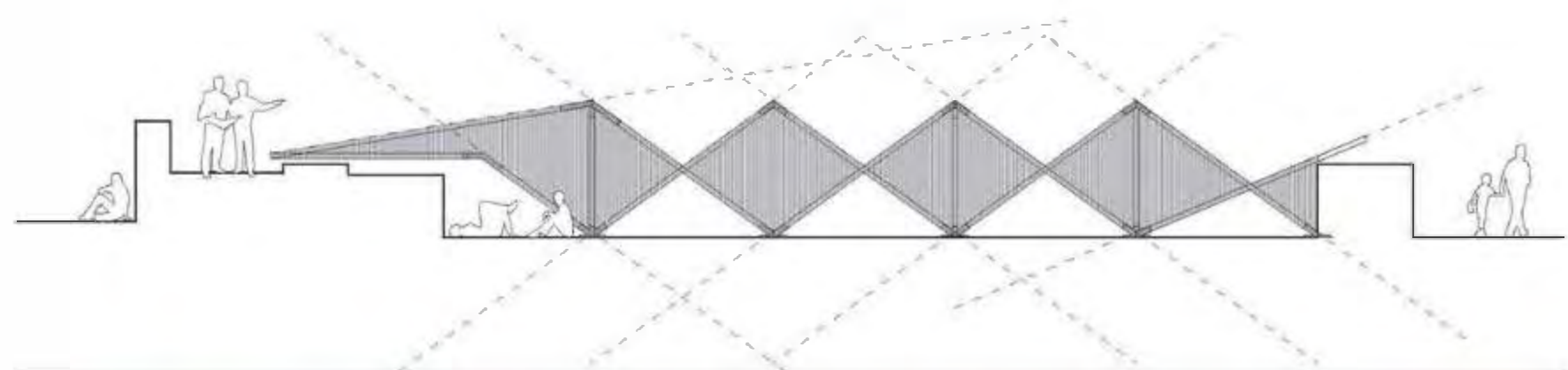


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- 1, 2 "White" gallery installation in San Luis Obispo, 2011; design: Studio 400 of the California Polytechnic State University
3, 4 The World Design Capital Pavilion in Helsinki, 2012; design: Wood Studio of the Alvar Aalto University, Helsinki
5, 6 Temporary roof over a ruin in Marrakech, 2012; design: Barkow Leibinger Architects



5



6



2



7, 8 "Honey Scape", temporary pavilion in Ponte Lima, 2012; design: Gonçalo Castro Henriques / X-Ref
9 "White Noise", temporary pavilion in Salzburg, 2011; design: soma architects

the tips where three round pieces of timber meet. The feet stand in steel containers filled with stones, which hold the wooden members in place. Between these junctions, five workers laboured for two weeks, drawing cotton threads in a classical weaving technique. The digital design, the traditional materials and the manner in which they were worked complement each other to create an extremely sensuous object, demonstrating that experiments with load-bearing structures can be an interesting task even for established architectural practices. Also based on a hyperbolic paraboloid form, but quite different in its use of materials, is the temporary pavilion designed by

X-Ref for a garden show in Ponte Lima, Portugal (ills. 7, 8). Here, the free form was implemented as a lightweight construction with iridescent, orange polycarbonate web plates. The basic hexagonal units are joined together with metal clamps. Bent in two directions, the structure describes a parabolic curve. The hexagonal elements in the lower part are larger and higher than those at the top. Here, too, the form was created by digital means, but a large number of assistants were needed to erect the structure. The pavilion designed by soma for the Salzburg music biennial in 2011 is also a temporary object (ill. 9), although it is conceived to be used for a total of 10 years in different lo-

cations and for various artistic events. Its exciting external appearance is based on the use of square hollow-section tubes – all the same length – in glittering aluminium. To simplify the erection, the tubes were welded together to create elements of the same size. The digitally developed form was achieved by turning and juxtaposing these segments at different angles to each other. The examples described here are just a small selection from a much greater range of projects, revealing a delight on the part of students and architects in developing new structures. But even without an architectural training many people derive great pleasure from creating smaller objects of this kind.



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Sustaining Identity Symposium III

At a time when city centres with iconic buildings and globally branded retailing seem to resemble one another more and more, the one-day symposium *Sustaining Identity III* brings together acclaimed architects from different backgrounds whose work rejects homogenization by prioritizing place, memory and the senses, creating, in the words of architectural theorist Juhani Pallasmaa, an 'architecture of resistance'. 2012 Pritzker Prize laureate Wang Shu, 2012 Global Holcim Award winner Francis Kéré, Aga Khan Award winners Li Xiaodong and Anna Heringer, Bijoy Jain (Studio Mumbai), Rick Joy, Christopher Lee (Serie Architects), Josep Lluís Mateo, Declan O'Carroll (Arup Associates), Kongjian Yu (Turenscape) and Juhani Pallasmaa will all speak at this event, curated jointly by Pallasmaa and Paul Brislin of Arup Associates. 29 November 2012, Victoria and Albert Museum, London, www.vam.ac.uk



DETAIL Engineering 1: schlaich bergemann und partner

Christian Schittich (ed.), Institut für internationale Architektur-Dokumentation, Munich 2011. **softcover**, 136 pp., ISBN 978-3-920034-58-4, US\$52; £32.40; €39

'The art of building is an indivisible whole. In every structure, meaningful construction and eco-efficiency are as critical as functionality and design. Form and supporting structures are only effective if they meld together to become one entity that withstands scrutiny and is perceived as part of a comprehensive culture of building.' Upholding the maxim of its founder Jörg Schlaich, the engineering firm schlaich bergemann und partner has worked successfully for more than 30 years with a variety of architects on a highly diverse range of projects all over the world. Now under its second generation of leadership, the firm continues to exemplify clear and innovative designs for bridges, buildings and solar power plants as well as a holistic approach to the theory and practice of engineering.

Next 3 Stadia. Warsaw Bucharest Kiev

Falk Jaeger (ed.), Jovis Verlag, Berlin 2012, **hardcover**, 184 pp., Text German/English, ISBN 978-3-86859-154-5, US\$59.95; £34; €34

This book introduces three new stadia built by gmp architects in collaboration with the engineers of schlaich bergemann und partner: the national stadium in Warsaw and the Olympic stadium in Kiev (see p. 620ff and p. 570ff), built for the 2012 European Football Championships in Poland and Ukraine, and the new arena in Bucharest. The detailed information on their design and construction is supplemented with a discussion of their respective locations.

Helen & Hard. Relational Design

Martin Braathen, Reinhard Kropf, Siv Helene Stangeland (eds.), Hatje Cantz, Ostfildern 2012, **hardcover**, 264 pp., ISBN 978-3-7757-3134-8, US\$70; £45; €49.80

This publication is dedicated to Helen & Hard's philosophy of "relational design", in which building is adapted to circumstances and constraints are regarded as guiding points of departure rather than necessary evils. Exemplars of this philosophy are the Norwegian pavilion for the Expo 2010 in Shanghai, as well as the Vennesla Library and Cultural Centre (see p. 596ff). Meticulously designed, the book features paper in tones of eggshell and white. Its fabric cover, bearing an illustration by the architects, deserves a second look.

Chromazone: Colour in Contemporary Architecture
19 November 2012 to 19 May 2013, V&A, London, www.architecture.com

The Polychrome Lens: Colour in Architectural Photography
15 November 2012 to 31 January 2013, RIBA, London, www.architecture.com

Emerging Architecture
30 November 2012 to 1 March 2013, RIBA, London, www.architecture.com

21st Century Light Space Modulator: An Installation by Jason Bruges Studio
14 November 2012 to 29 January 2013, RIBA, London, www.architecture.com

RA Now – Royal Academicians from Anish Kapoor to Zaha Hadid
Until 11 November 2012, Royal Academy of Arts, London, www.royalacademy.org.uk

Housing London
Until 21 December 2012, NLA, The Building Centre, www.newlondonarchitecture.org

White Room / Black Room: Alexander Brodsky
Until 25 November 2012, Calvert 22 Art Foundation, London, www.calvert22.org

Importing Architecture
16 November 2012 to 7 April 2013, Nasjonalmuseet, Oslo, www.nasjonalmuseet.no

Massimo Scolari: The Representation of Architecture, 1967–2012
Until 21 November 2012, The Cooper Union, New York, www.cooper.edu

The Edgeless School: Design for Learning
Until 19 January 2013, The Center for Architecture, New York, cfa.alany.org

Detroit Is No Dry Bones Photographs by Camilo José Vergara
Until 18 February 2013, National Building Museum, Washington, DC, www.nbm.org

Detroit Disassembled Photographs by Andrew Moore
Until 18 February 2013, National Building Museum, Washington, DC, www.nbm.org

Play Work Build
Opening 18 November 2012, National Building Museum, Washington, DC, www.nbm.org

Antibodies: The Works of Fernando and Humberto Campana 1989–2009
10 November 2012 to 24 February 2013, Palm Springs Art Museum, Palm Springs, www.psmuseum.org



Temporary Pavilion in Noda

Architects:

Kazuhiro Kojima + Kojima Laboratory,
Tokyo University of Science

Team:

Kayoko Sakashita, Kumiko Sato, Bonkun
Shin, Yusuke Takizawa, Takeshi Harikai,
Koji Matsushita, Yuka Mukai, Eiichiro Moriya,
Takuma Yokomae

Structural engineers:

Jun Sato Structural Engineers, Tokyo

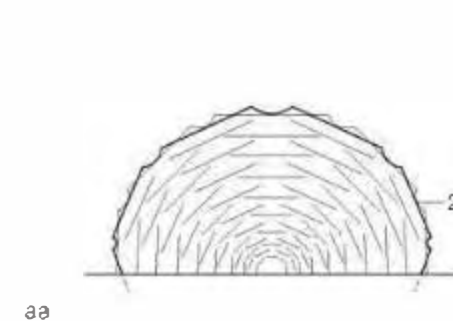
Others involved in the project: see page 676

www.detail.de

Architectural students at the Tokyo University of Science, in conjunction with lecturers, a structural planner and a membrane manufacturer, developed an experimental, extremely lightweight, load-bearing structure for a temporary pavilion. The 26-metre-long, up to 7.5-metre-wide and 4.25-metre-high volume is self-supporting and comprises only two kinds of component: the metal bearing elements and a delicate space-enclosing skin. The latter, consisting of an 0.7 mm membrane of elastic polyester fabric, is drawn over metal tubes that create a tensegrity system. In this case, the membrane forms the tensioning element. The compression bars are Ø 25 mm aluminium

tubes of various lengths. There is no contact between the 131 individual tubes; instead, they are connected to the membrane by sliding the ends into sheaths sewn on. The skin is anchored at the base like a conventional tent with pegs. Here, they are in the form of aluminium tubes, the tips of which are pressed together to form a point. The compression members are pushed into these pegs and fixed with steel pins. Also attached to the pins are the eyelets by which the foot of the membrane is secured. With a weight of only 600 kg, this airy structure covers a ground area of 146 m². The pavilion was erected by 70 students in a single day. Initially, they laid out the ready-

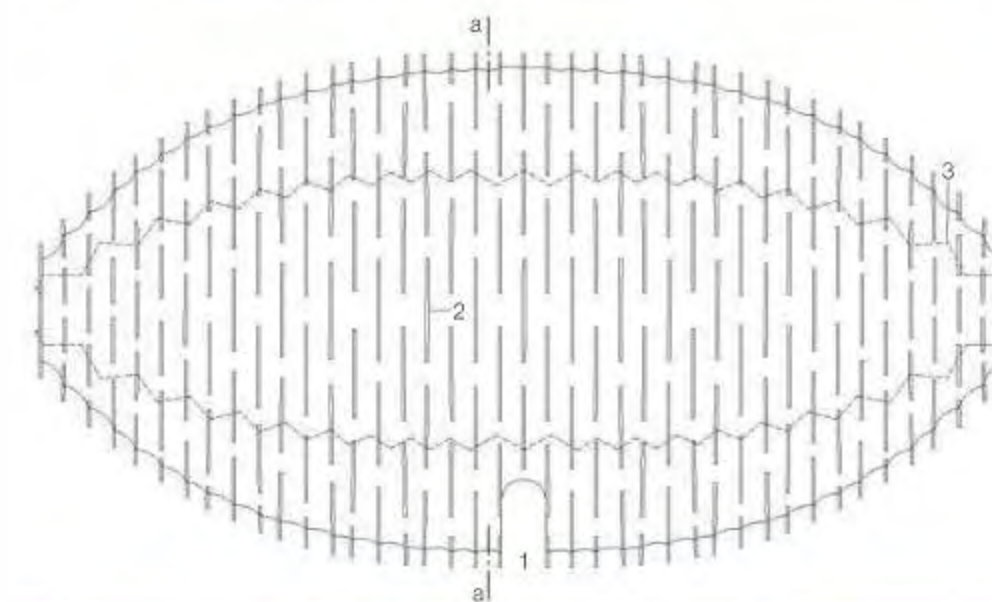
tailored skin, then slid the tubular members into the sheaths. The overall structure was tensioned on all sides, pushed upwards at the same time in the interior and finally fixed to the ground. The convex and concave forms resulting from this create an animated surface and a lively interplay of light and shade. The membrane screens of 80 per cent of the UV radiation, but allows 50 per cent of the daylight to pass through. The softly filtered light creates a fascinating spatial impression internally. In the evening, the translucent pavilion has the appearance of an illuminated sculpture. Erected on the university campus for a week to hold seminars, it is now in store awaiting a new use.



aa

Section
Membrane laid flat
scale 1:250

- 1 Entrance
- 2 Compression bar
- 3 Foot/Peg

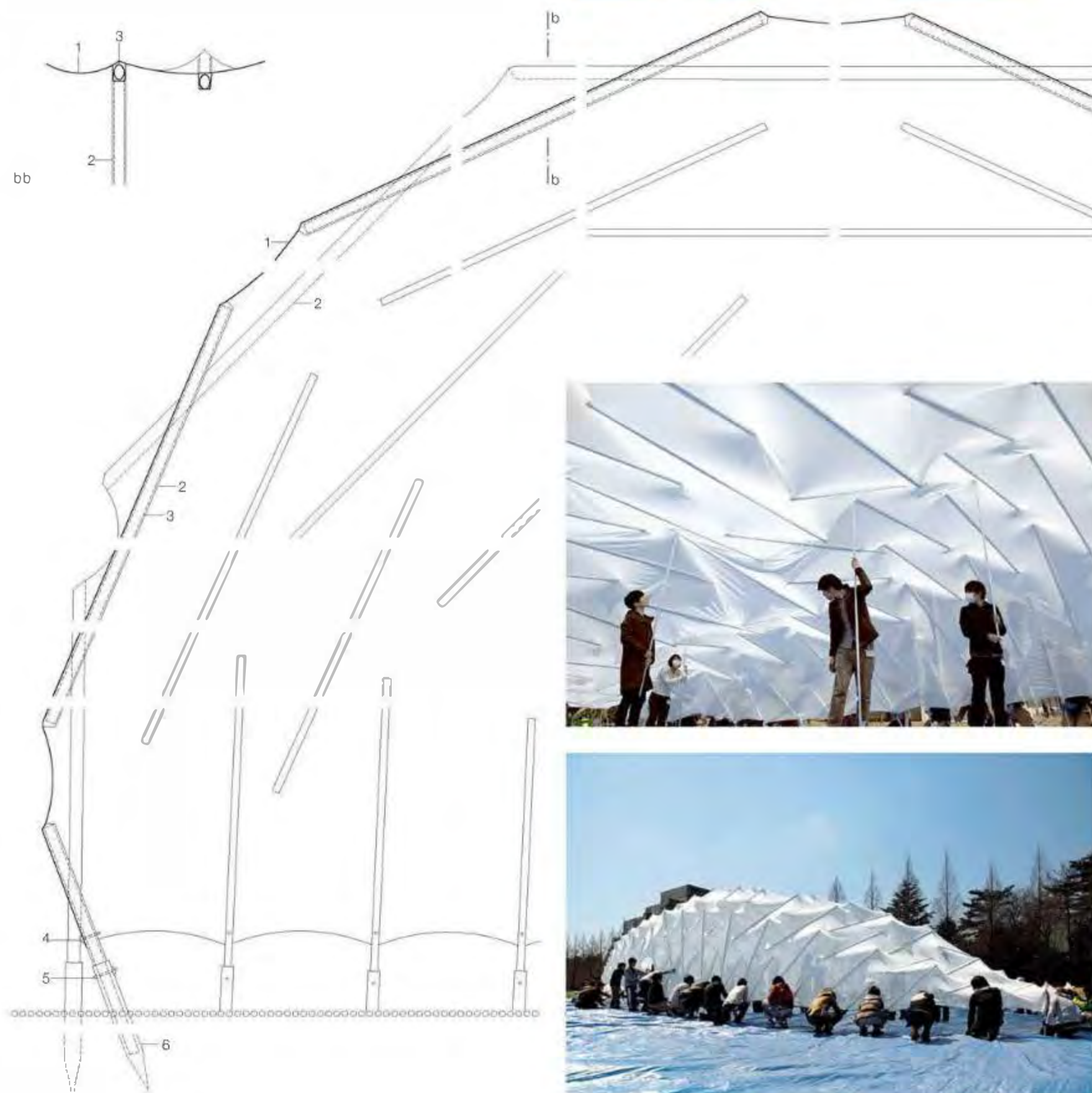


Sections
scale 1:20

- 1 0.7 mm white polyester fabric membrane:
50 per cent transparency
80 per cent UV filter

- 2 membrane sheath, sewn on

- 3 ● 25/3 mm tubular aluminium compression bar
500–2,800 mm long
4 eyelet for fixing membrane at foot
5 M5 bolt fixing
6 ● 34/2.3 mm tubular aluminium peg, tip pressed together



Sun Moon Lake Visitors' Centre and Administrative Building near Yuchi

Architects:

Norihiko Dan and Associates, Tokyo

Team:

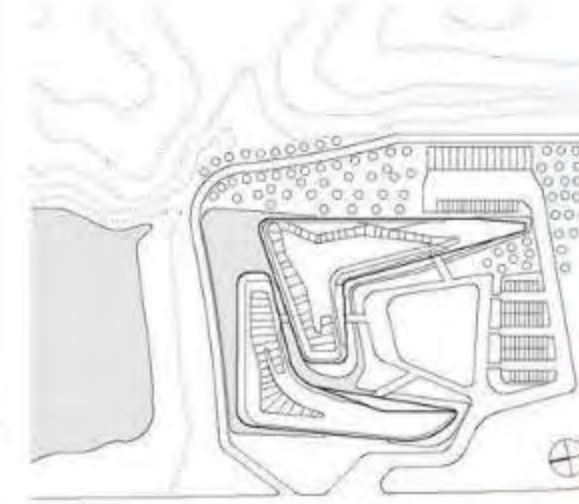
Norihiko Dan, Tadashi Yoshimura, Eiji Sawano, Minghsien Wang, Masato Shiihashi

Structural engineers:

Structural Design Group, Tokyo

Horn Gyun Engineering Consultants, Taipei

Others involved in the project: see page 676



Site plan scale 1:5000

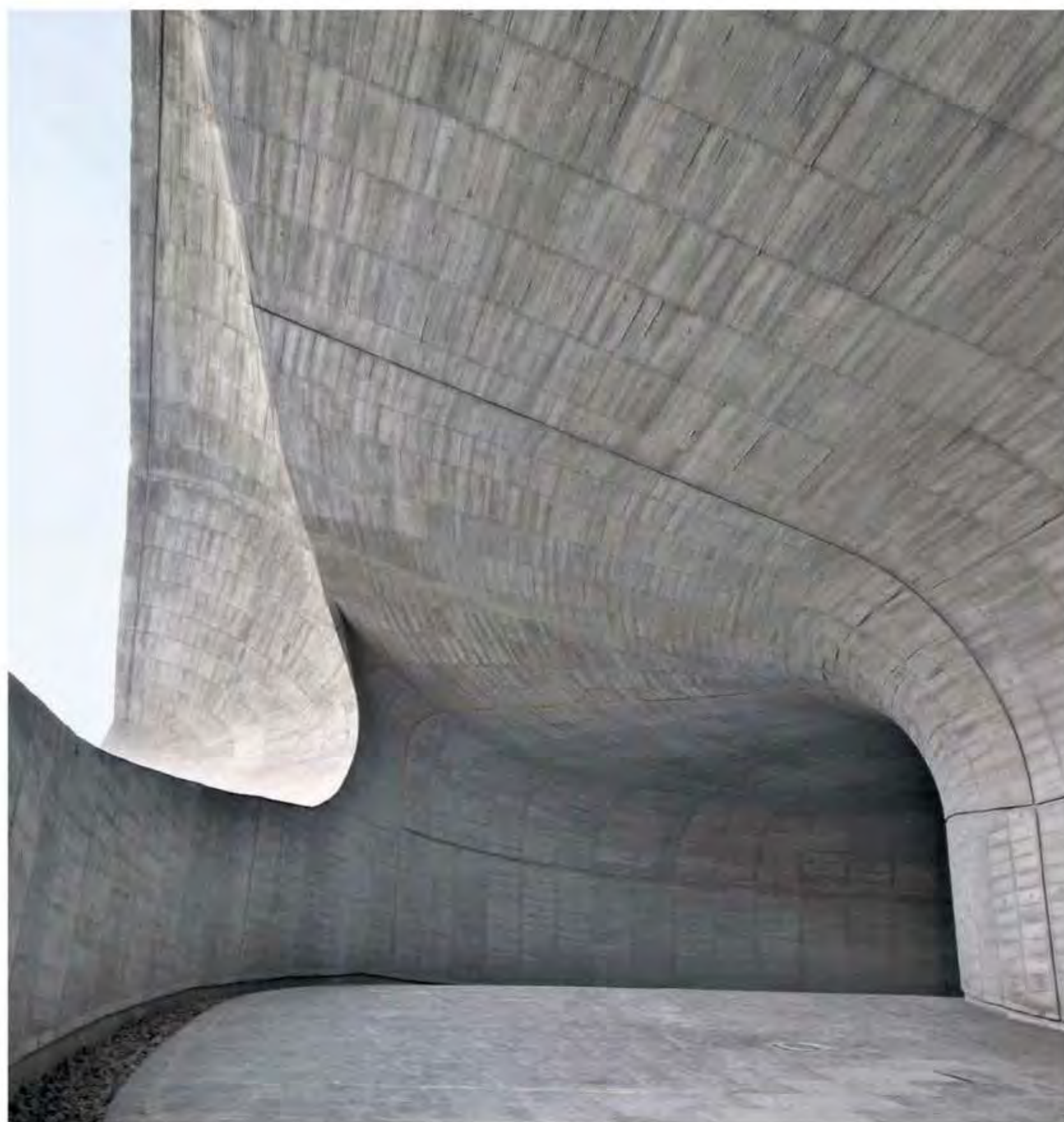
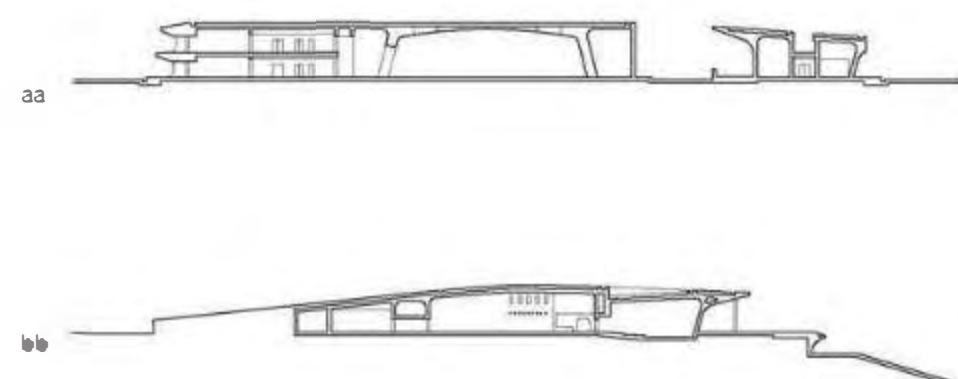


The Sun Moon Lake, set in a hilly, wooded landscape, is the largest inland area of water in Taiwan and a popular destination for honeymoon couples. In 2003, a competition was held for a new visitors' centre on the western shore of this artificial lake. It was won by the Tokyo architect Norihiko Dan with a dynamically curved design. Laid out offset to each other are two boomerang-shaped volumes. The western wing accommodates the visitors' centre, together with exhibition galleries and lecture spaces, as well as a cafe with a panoramic view. The eastern wing contains the offices of the park administration. Ramps lead up to the two roofs, the large terraces of which afford ex-

tensive views over the landscape. A flowing transition was to be created between the buildings and the topography. In this way, the two volumes with their planted roofs seem to grow from the site. Broad gateways at the entrance level dramatize the vista, framing the landscape like huge windows so that the external space becomes part of the building. In addition, further areas of water set in front dissolve the boundaries between the terrain and the buildings themselves. An impressive feature of the two wings is the sculptural appearance of their exposed-concrete volumes. Spans of up to 35 metres plus large cantilevered sections with re-

duced roof depths presented a challenge to the structural engineers and construction firms. The broad arches were executed in a clearly defined, prestressed-concrete form of construction, not unlike that of bridge structures. Contrasted with these powerful forms is the fine texture of the exposed-concrete surfaces with their boarded finish, using Japanese cedar formwork. Precise ar- rises, rounded edges with tight radii, openings of three-dimensional character and the staccato arrangement of the piers all testify to the performance and expressive qualities of reinforced concrete – an attractive interplay of solid volumes and permeability, of curved surfaces and clear, sharp lines.

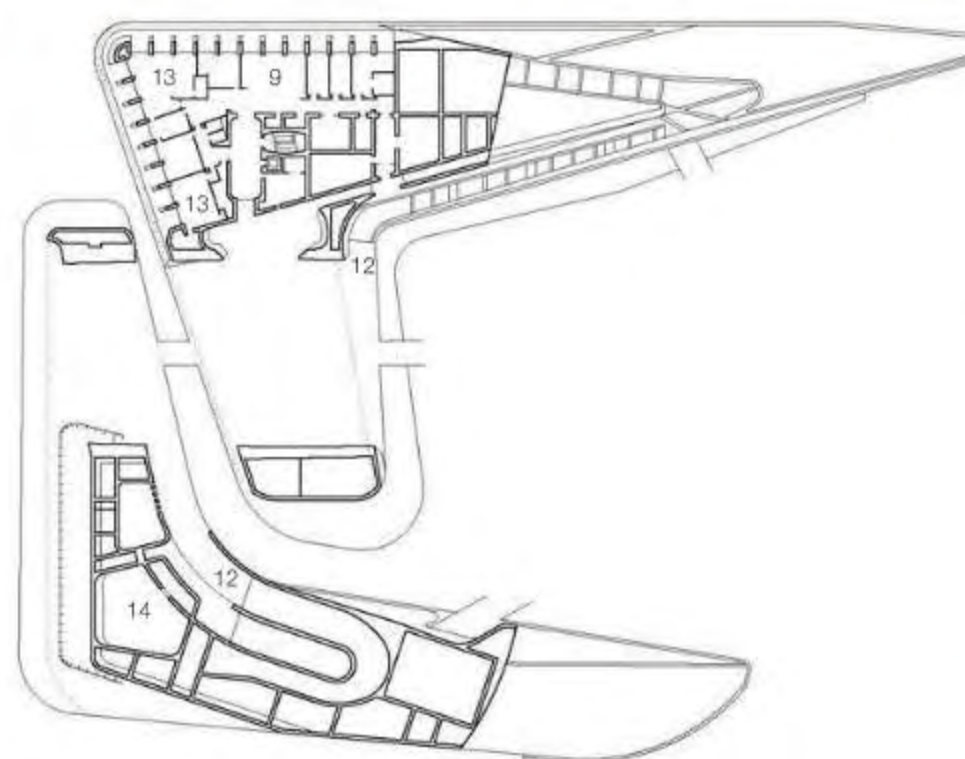




Sections
Layout plans
scale 1:1500

- 1 Parking area
- 2 Covered outdoor areas / Viewing platform
- 3 Pool of water
- 4 Entrance to visitors' centre

- 5 Cafe
- 6 Exhibition spaces
- 7 Lecture room
- 8 Entrance to administration offices
- 9 Conference space
- 10 Canteen
- 11 Ramp to roof terrace
- 12 Management
- 13 Void

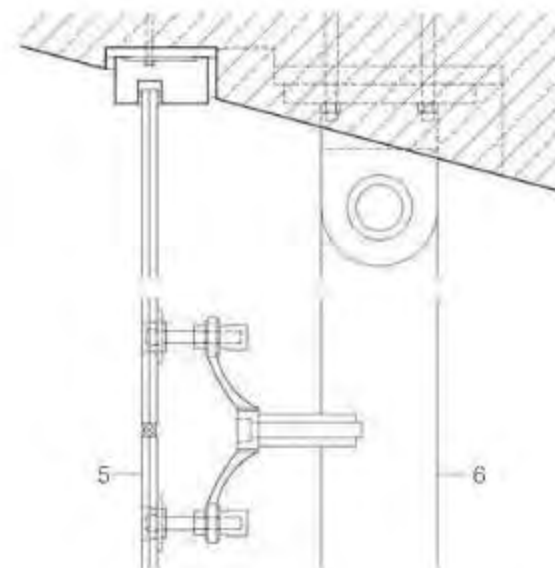


First floor

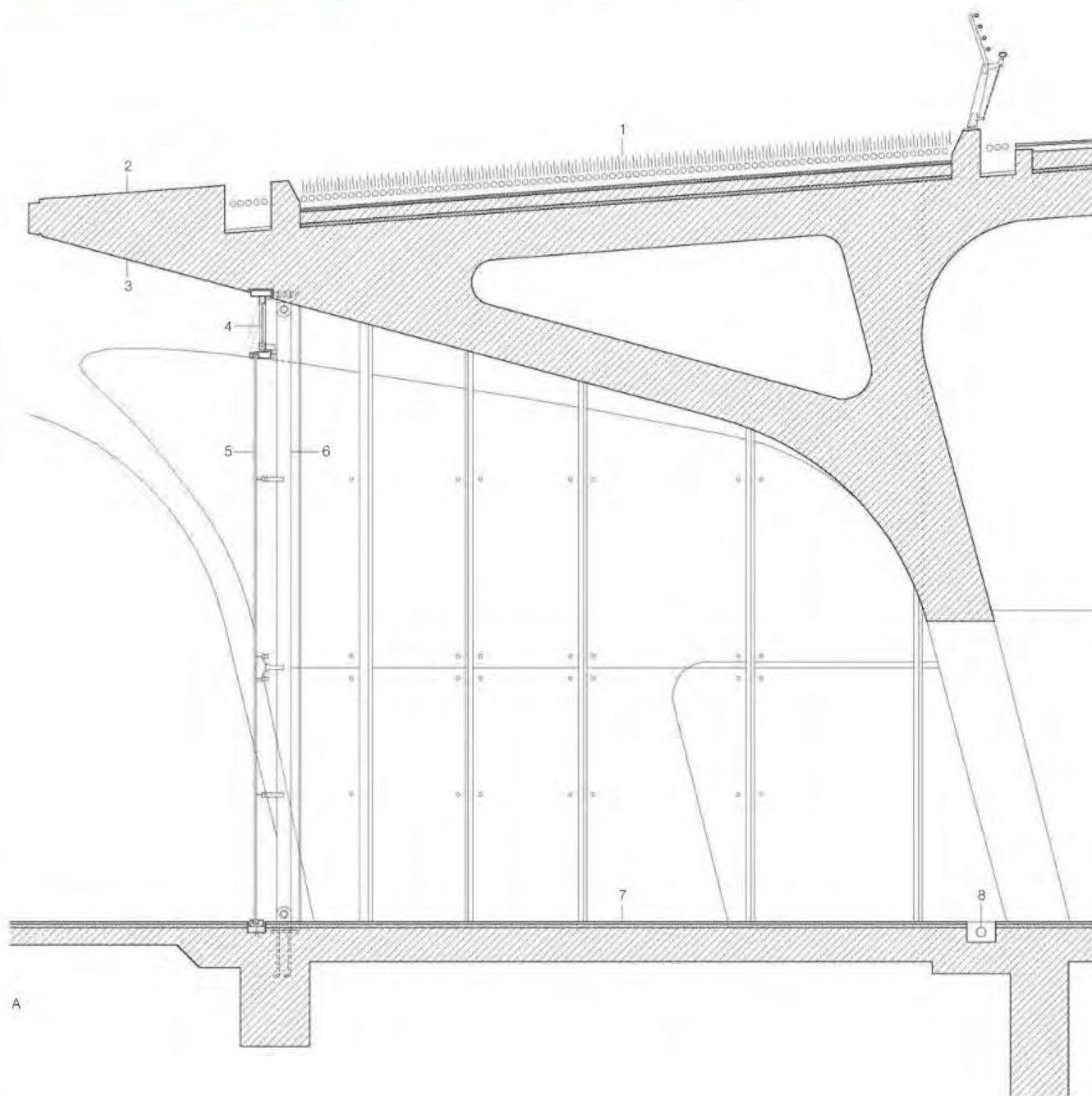


Ground floor





Vertical section through glazed facade: junction between fixed glazing and roof
scale 1:10
Section scale 1:50



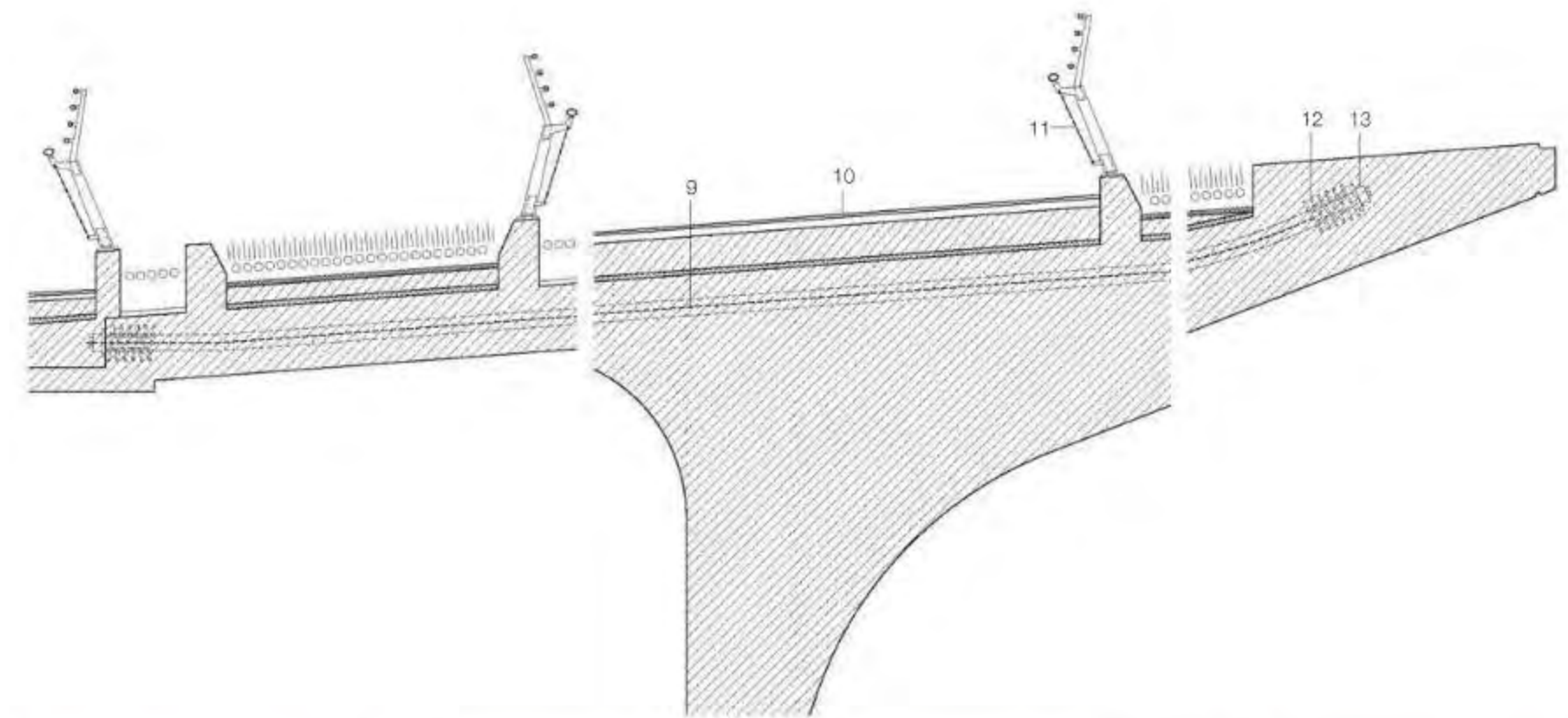
A

- 1 roof construction:
200 mm extensive planting and substrate layer
30 mm drainage layer
100 mm concrete topping
30 mm expanded polystyrene thermal insulation
rapid-curing polyurethane seal

- highly compacted exposed concrete
- 2 eaves wedge:
milky-white waterproof coating
rapid-curing polyurethane seal
- 3 milky-white waterproof coating
exposed concrete with Japanese cedar formwork

- 4 powder-coated stainless-steel smoke flap in frame
- 5 16 mm laminated safety glass, point-fixed
- 6 column: 2 x 12/120 mm steel sections
- 7 PVC flooring in cafe
- 8 recessed light fitting

- 9 ● 12.7 mm prestressing cable in ● 22 mm cable sheath
- 10 roof terrace: 10 mm ceramic tiles in bed of mortar
- 11 stainless-steel balustrade: netting in tubular frame
- 12 helical reinforcement
- 13 anchor plate



Artist's Studio on Fogo Island

Architects:

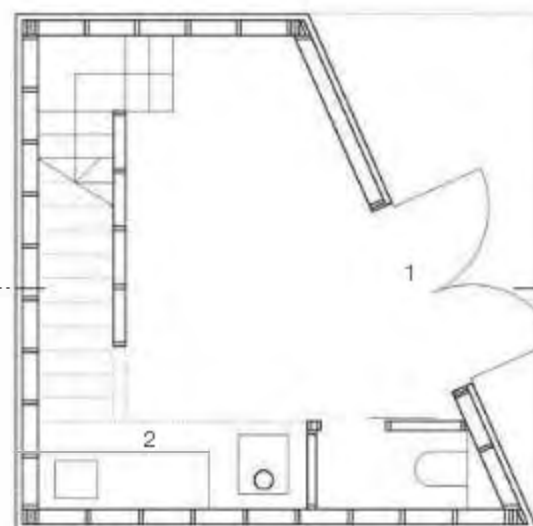
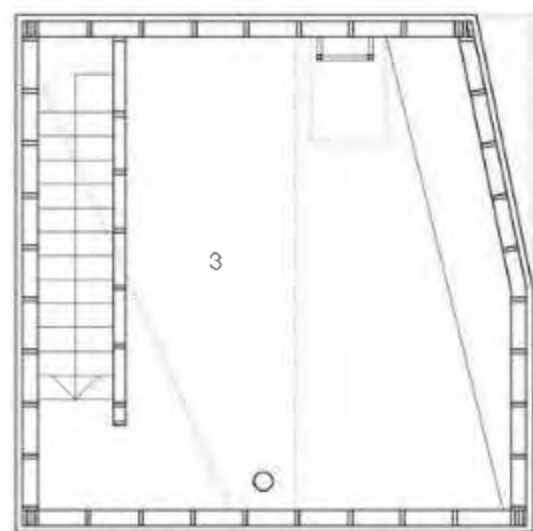
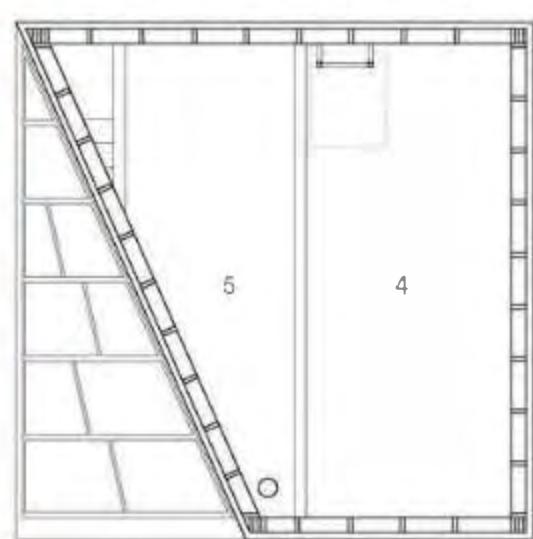
Saunders Architecture, Bergen

Team:

Atila Bóres, Ryan Jørgensen, Ken Beheim-Schwarzbach, Nick Herder, Rubén Sáez López, Soizic Bernard, Colin Hertberger, Christina Mayer, Oliver Bourgeois, Pål Storsveen

Others involved in the project: see [page 576](#)

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Fogo Island
scale 1:500000
A Fogo Island Inn
B Long Studio
C South Studio
D Short Studio
E Bridge Studio
F Fogo Studio
G Tower Studio

Floor plans + Section
scale 1:100
1 Entrance area
2 Kitchen strip
3 Studio
4 Gallery
5 Void

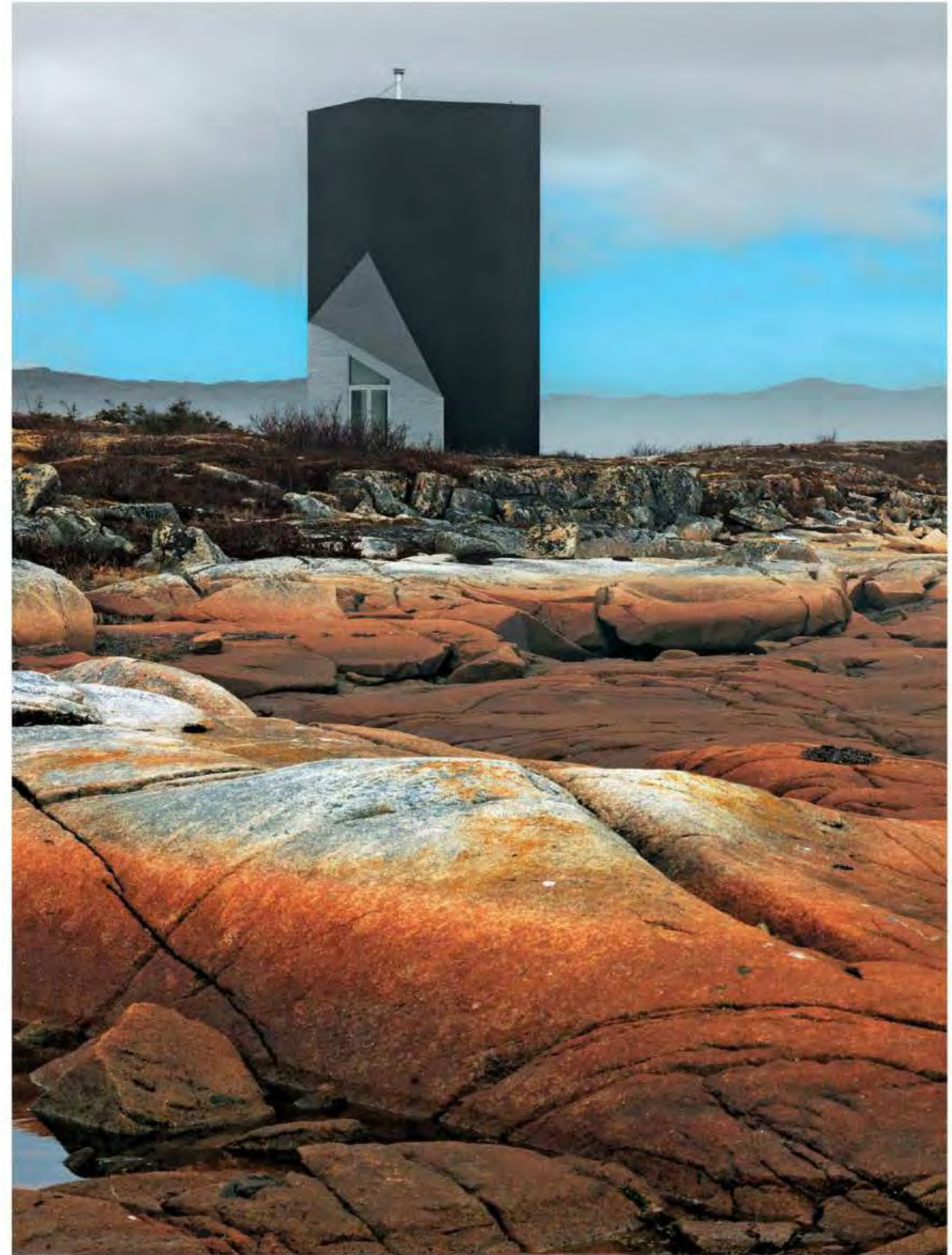
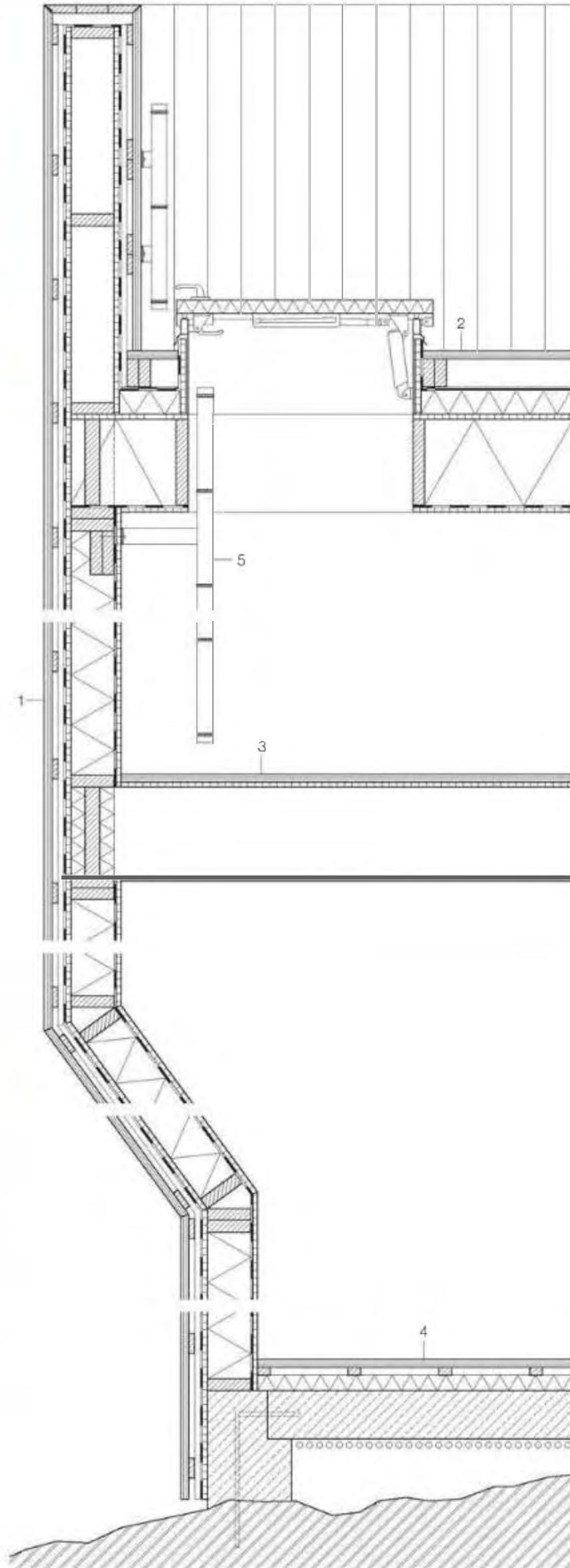


On the small island of Fogo, roughly 20 kilometres off the coast of Newfoundland, the curiosity of visitors has been aroused of late by six abstractly shaped, black-and-white cubes. These artists' studios are designed to create cultural and economic attractions on the island without impairing the sensitive ecological system. In these remote houses, both foreign and native artists can work undisturbed in the rough landscape of rocks and moorland, while they actually reside in traditional houses – refurbished in the context of this project – in the conurbations. The autonomous studios are fitted out with solar or photovoltaic panels, fireplaces, water cisterns and composting toilets. The latest to be erected is the Tower Studio, a structure that winds its way roughly 10 m upwards with offset diagonal and sloping surfaces. Weather protection is afforded by triangular areas of the facade that project out over the entrance and towards the northern light with its non-glare quality. The architects developed the timber-frame structure on the basis of a prototype that served building workers as a model. The material was delivered via a narrow, temporary walkway. Plywood sheeting was used to brace the structure on both faces. The outer skin consists of black-painted native softwood, while internally, the white finish to walls, soffits and floors helps to dissolve spatial boundaries.



Vertical section
scale 1:20

- | | | | |
|---|---|--|---|
| 1 | 25/125 mm softwood boarding
19/64 mm battens and counterbattens
windproof layer
16 mm plywood
38/140 mm softwood posts with 140 mm thermal insulation between vapour barrier
16 mm plywood | 200 mm thermal insulation
vapour barrier
16 mm plywood | |
| 2 | 25 mm softwood roof boarding
38/90 mm softwood bearers
two-layer bituminous seal
70 mm rigid-foam insulation
16 mm plywood | 3 | 25 mm softwood floor boarding
16 mm plywood
38/200 mm wood joists
16 mm plywood |
| | | 4 | 25 mm softwood floor boarding
40/25 mm battens
50 mm rigid-foam insulation
155 mm reinforced concrete floor
bed of gravel |
| | | 5 | ladder:
50 mm steel flats |



Library in Vennesla

Architects:

Helen & Hard, Stavanger

Team:

Reinhard Krøpf, Siv Helene Stangeland,

Håkon Minnesjord Solheim, Randi Augenstein,

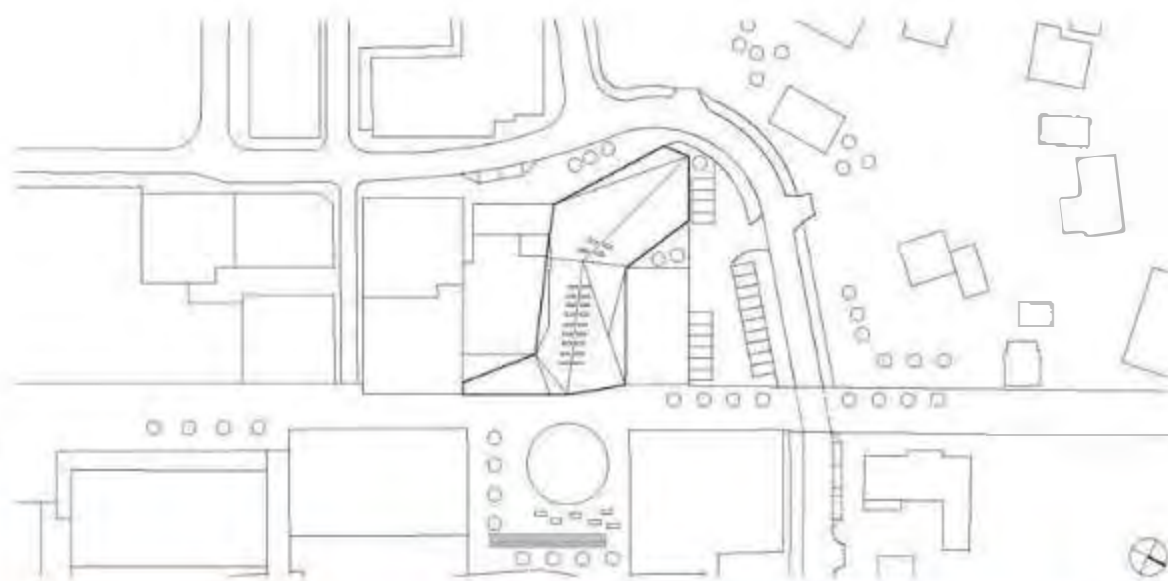
Njål Undheim, Caleb Reed

Structural engineers:

Rambøll, Kristiansand

Moelven, Moelv

Others involved in the project: see page 676



Modern municipal libraries may no longer be regarded simply as quiet places where people can read and study in peace. Nowadays, institutions of this kind are more likely to be public meeting places, as one sees in the case of this development in Vennesla, southern Norway, with its in-house cafe. Situated at the centre of the town, the new structure closes a gap between an existing cinema and an educational centre, linking these buildings with each other and at the same time tautening the urban fabric. The large, glazed facade that opens on to the pedestrian zone on the north-eastern side makes an inviting gesture to potential visitors, offering a sheltered outdoor sitting

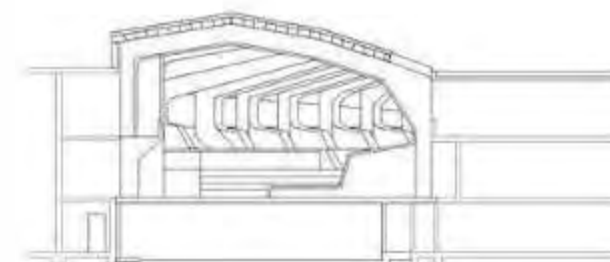
area in the form of an urban loggia. The vertical, strip-like sunshading elements on the rear, south-western face lend the building the appearance of a uniform volume, yet one that clearly distinguishes itself from the neighbouring developments. All important functions of the library are united in an ample internal space that derives its striking identity from the visible load-bearing structure – consisting of laminated-timber arched beams. As a symbiosis of supporting structure, technical outfitting and furnishing, these bold architectural elements wind their way through the entire building, matching their form to the spatial geometry and the functional needs of the library.

Site plan
scale 1:2000

- 1 Office
- 2 Classroom
- 3 Lecture hall
- 4 Local history/
geography
department
- 5 Discussion
space
- 6 Mechanical
services
- 7 Lower foyer
- 8 Cleaning room
- 9 Periodicals
- 10 Cinema

Sections
Floor plans
scale 1:500

- 11 Cinema
box office
- 12 Cloakroom
- 13 General library
- 14 Youth books
department
- 15 Children's
books department
- 16 Information centre
- 17 Films and music
- 18 Newspapers
- 19 Educational
centre
- 20 Cafe



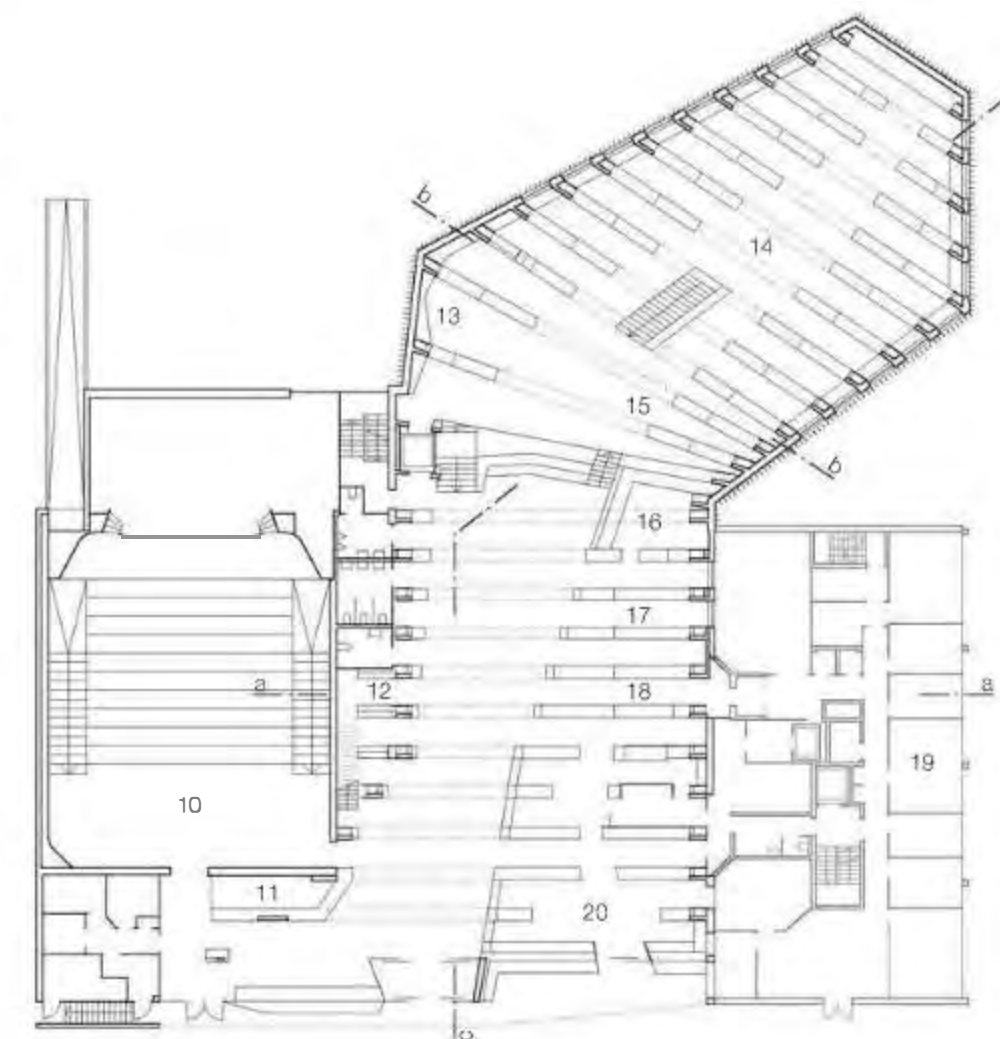
aa



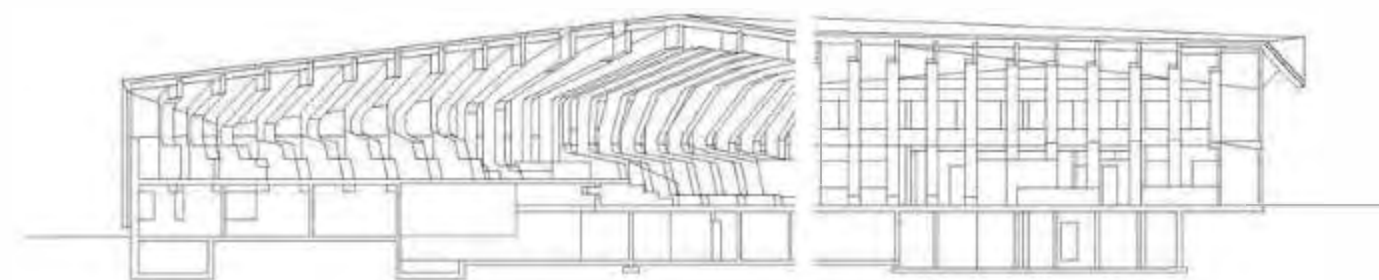
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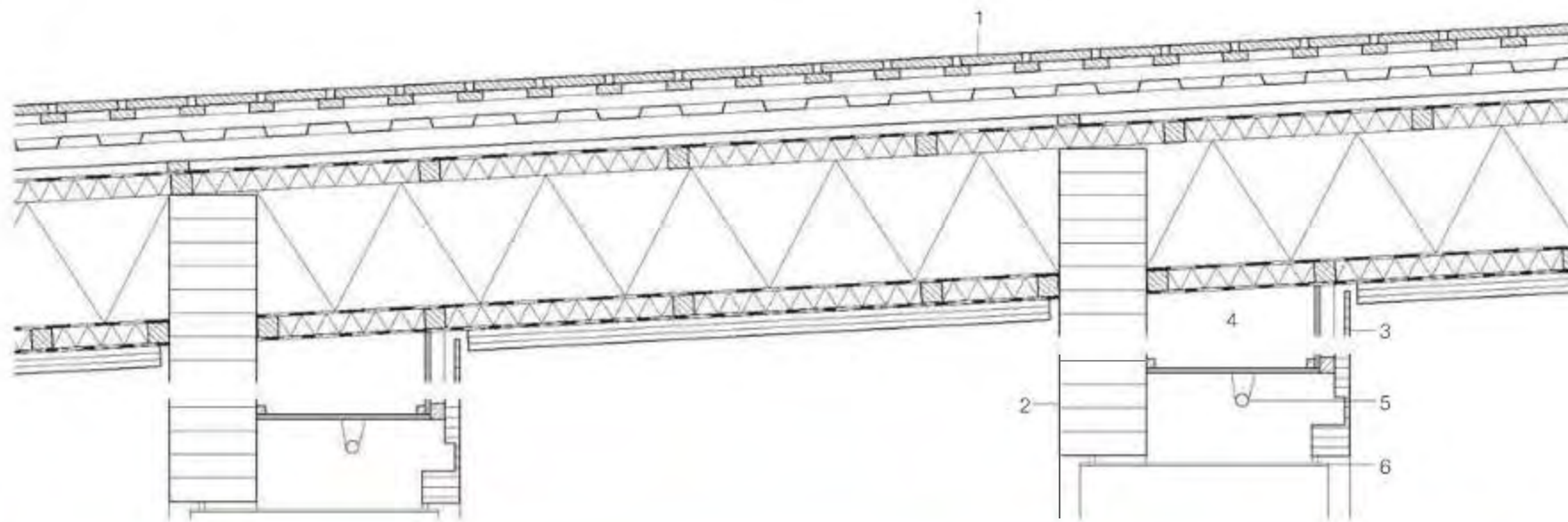
Basement



Ground floor



cc

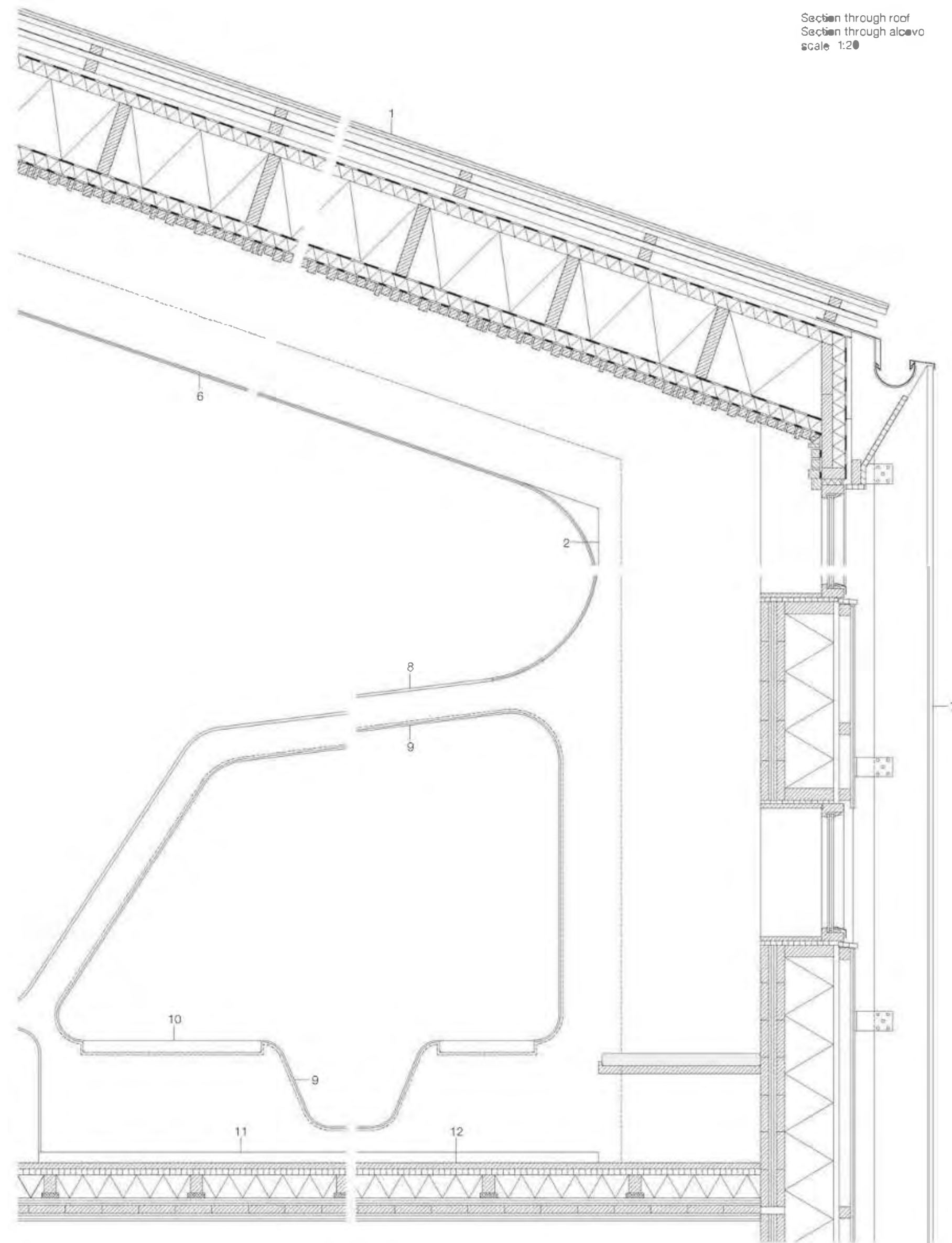


1 pine heartwood roof cladding:
23/98 mm cover boarding
23/69 mm underboarding
36/48 mm battens
(rear ventilation)
25 mm trapezoidal-section
metal sheeting
48 mm battens
(rear ventilation)
25 mm counterbattens
sealing layer
50 mm battens/
50 mm insulation
300 mm rafters with

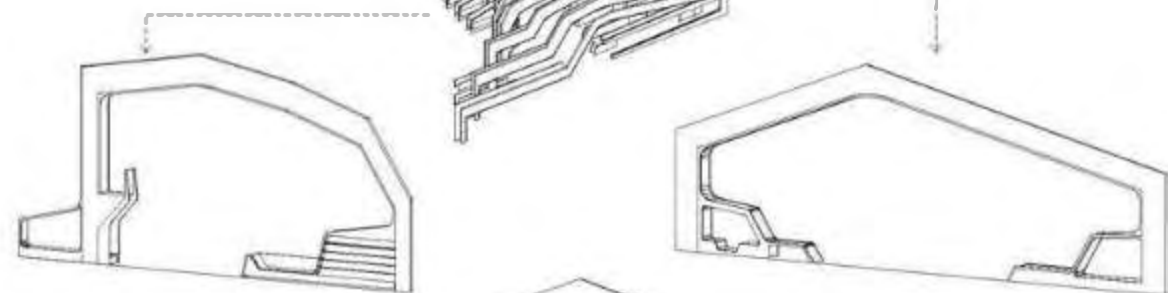
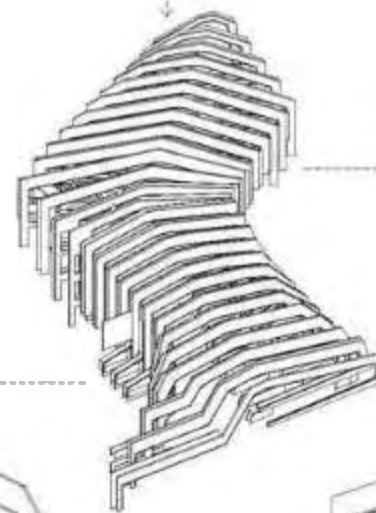
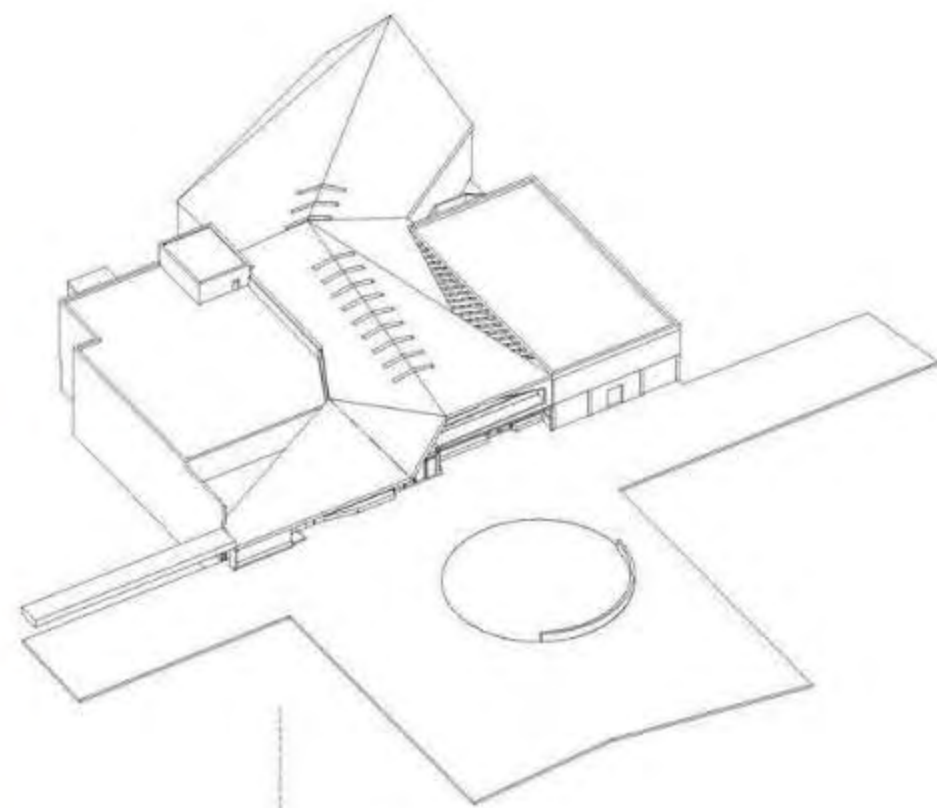
insulation between
vapour barrier
50 mm battens/
50 mm insulation
acoustic mat
acoustic soffit:
various wood strips,
ca. 36/36 mm
2 220/1200 to 260/1400 mm
laminated timber beam
sealing layer
3 12 mm birch-veneered
acoustic panel
4 integral ventilation duct with
fire-resisting painted finish

5 LED fitting
6 6 mm satin-finish
fire-resisting
polycarbonate sheeting
7 50/250 mm vertical
pine sunscreen louvres
23/148 mm pine cladding
48/48 mm horizontal battens
36/98 mm vertical counterbattens
200 mm rock-wool insulation
95 mm cross-laminated timber
wall lining
8 9 mm plywood lining with
concealed fixings, painted

9 4 mm linoleum lining
9 mm plywood
10 cushion let into furniture fitting
11 12/58 mm oak strip
12 28 mm red oak
industrial parquet
22 mm medium-density
fiberboard subfloor layer
48/73 mm wood bearers
on neoprene strips
with insulation between
95 mm cross-laminated timber
200/400 mm laminated
timber beams



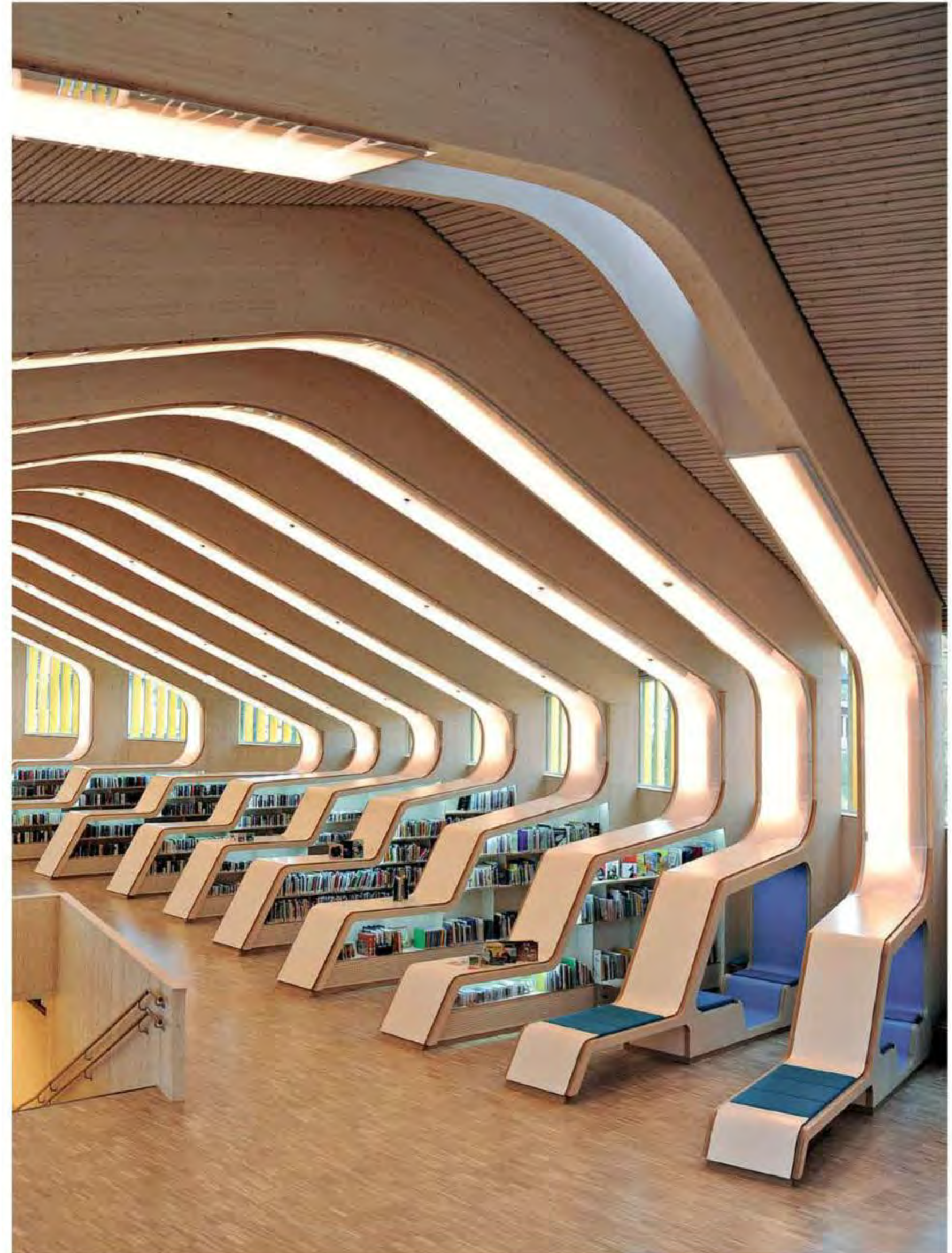
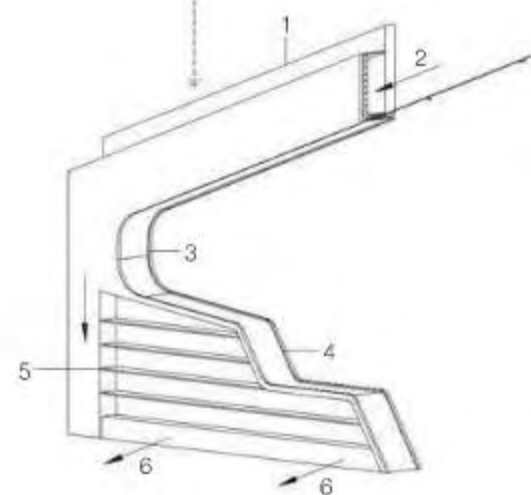
Section through roof
Section through alcove
scale 1:20



Isometric

- 1 laminated timber beam
- 2 air intake
- 3 polycarbonate light diffuser
- 4 plywood cladding
- 5 bookshelves
- 6 air outlets

The load-bearing structure comprises a total of 27 rib girders the alignments of which are shifted in order to accommodate them to the adjoining buildings. The different shapes of these members lend the roof its individual form as well as creating the wave-like layout of the hall. The girders act as roof beams with columns in which ventilation runs are housed. Incorporated in the construction are bookshelves and recesses for reading – according to needs and the location. All girders consist of prefabricated laminated-timber elements and are clad with plywood sheeting (shaped by CNC technology) and with curved panes of glass in part, which serve as coverings for the LED fittings.



Tram Depot in Berne

Architects:

Penzel Valier, Zurich

Team:

Ralf Gartmann, Gino Guntli, Claudia Loewe, Niklaus Lehri, Christian Penzel, Tim Schäfer, Roland Schmed, Roland Siegel, Martin Valier, Stephanie Weiss, Laura Zraggen
Others involved in the project: see page 676

Trams are a popular and, at the same time, environmentally friendly means of transportation. In Berne, the network is to be extended in the coming years, and the growing fleet of vehicles calls for a larger depot. The new structure planned for the edge of the city is a symbiosis of architectural design and structural planning. The parking and maintenance hall for 28 trams has to provide all prerequisites for an extension in two construction stages. A load-bearing structure was developed by the planners that complies with the building regulations in all three phases – despite a doubling of the floor area – and that is also able to meet the changing structural needs.

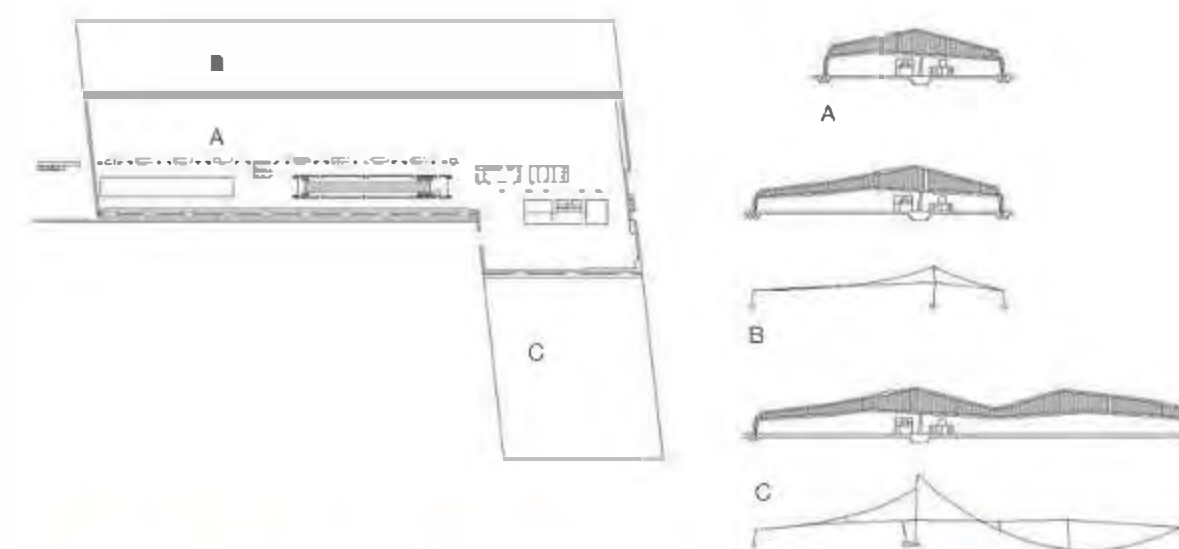
The competition jury was convinced above all by the clear organization and good functional qualities of the hall, with its large, column-free areas and modular installations. The dimensions and the L-shaped layout of the roughly 200-metre-long building were determined by the tight site conditions, the 42-metre length of a tram and the minimum turning radius. The 26 lateral trussed girders form a uniform, lattice structure through which daylight can enter. Internally, a central row of steel box columns articulates the hall like a spine, separating the parking from the working areas. The columns, set out in inclined pairs, form a V-shaped arrangement that provides lon-



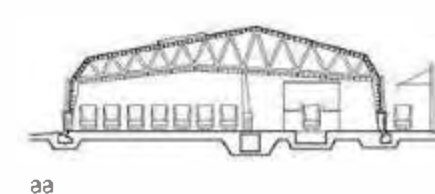
gitudinal bracing. Each axis is laterally stable, since the secondary beams between the trussed girders are rigidly bolted and function as part of a Vierendeel system. In the outer skin as in the roof, translucent and opaque areas alternate, with profiled glass segments ensuring even, diffuse daylighting. The closed areas are clad in sheet aluminium. Thanks to the solar heat gains via the glazed areas, no extra heating of the hall is necessary. Ventilation occurs by means of smoke and heat flaps in the lower part of the facade and in the shed roofs. In the first stage of the extension, the hall will be widened by roughly 26 m, whereby the rigid roof beams over the central col-

Diagrams of extension
scale 1:4000
A First stage
B Second stage
C Third stage

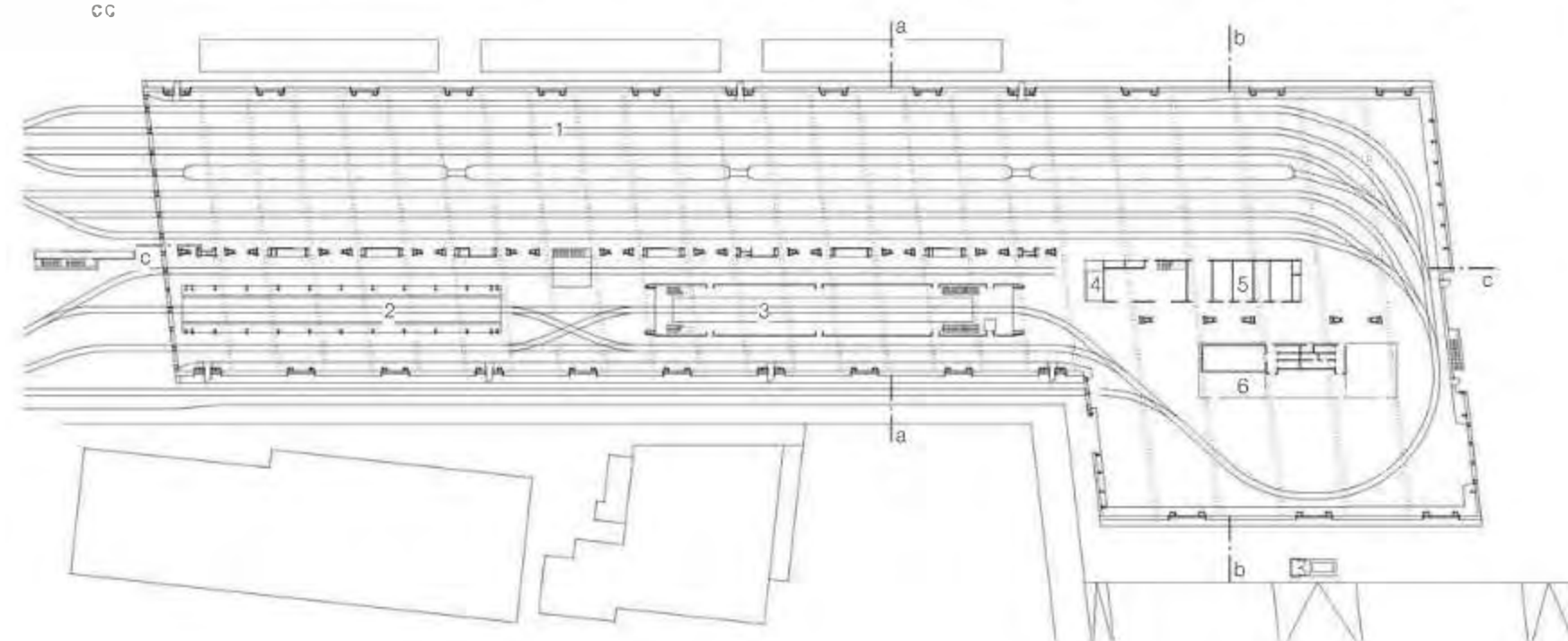
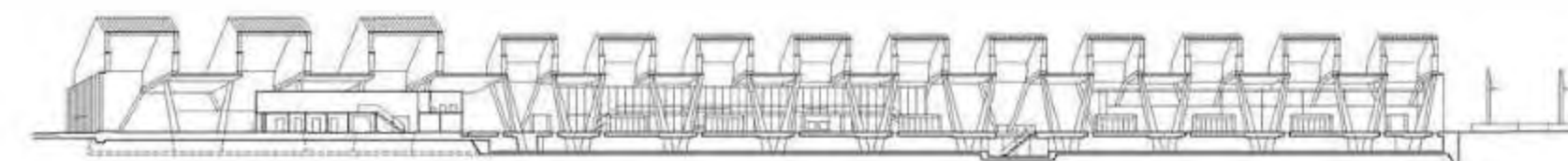
- 1 Parking area
- 2 Washing bay
- 3 Repair area
- 4 Sanding plant
- 5 Store
- 6 Operations area

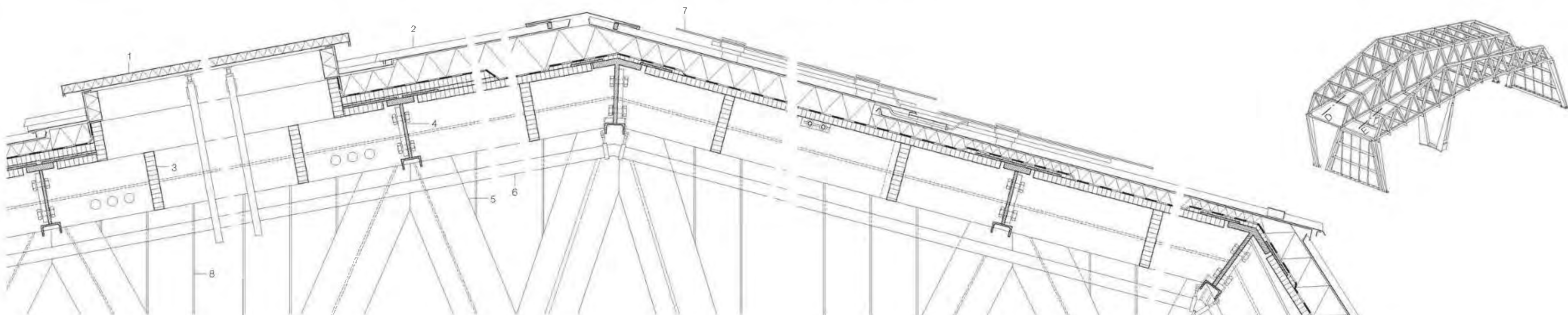


umns will be extended like crane booms and the facade removed and repositioned. The main loads from the trussed girders will thus bear on the rigid columns, and the outer skin will be relieved. The opposite facade will be subject to compression loads for the time being, but after the extension, these will be transformed into tension loading in a cross-sectionally neutral form. For that reason, the facade columns were fixed from the outset in the ground. In the final stage, a large workshop area will be created along the end face of the extension leg, with an increased span of 68 m. The hall will then achieve its ultimate form, reaching the load-bearing limits of the structure.



Sections · Floor plan
scale 1:1500

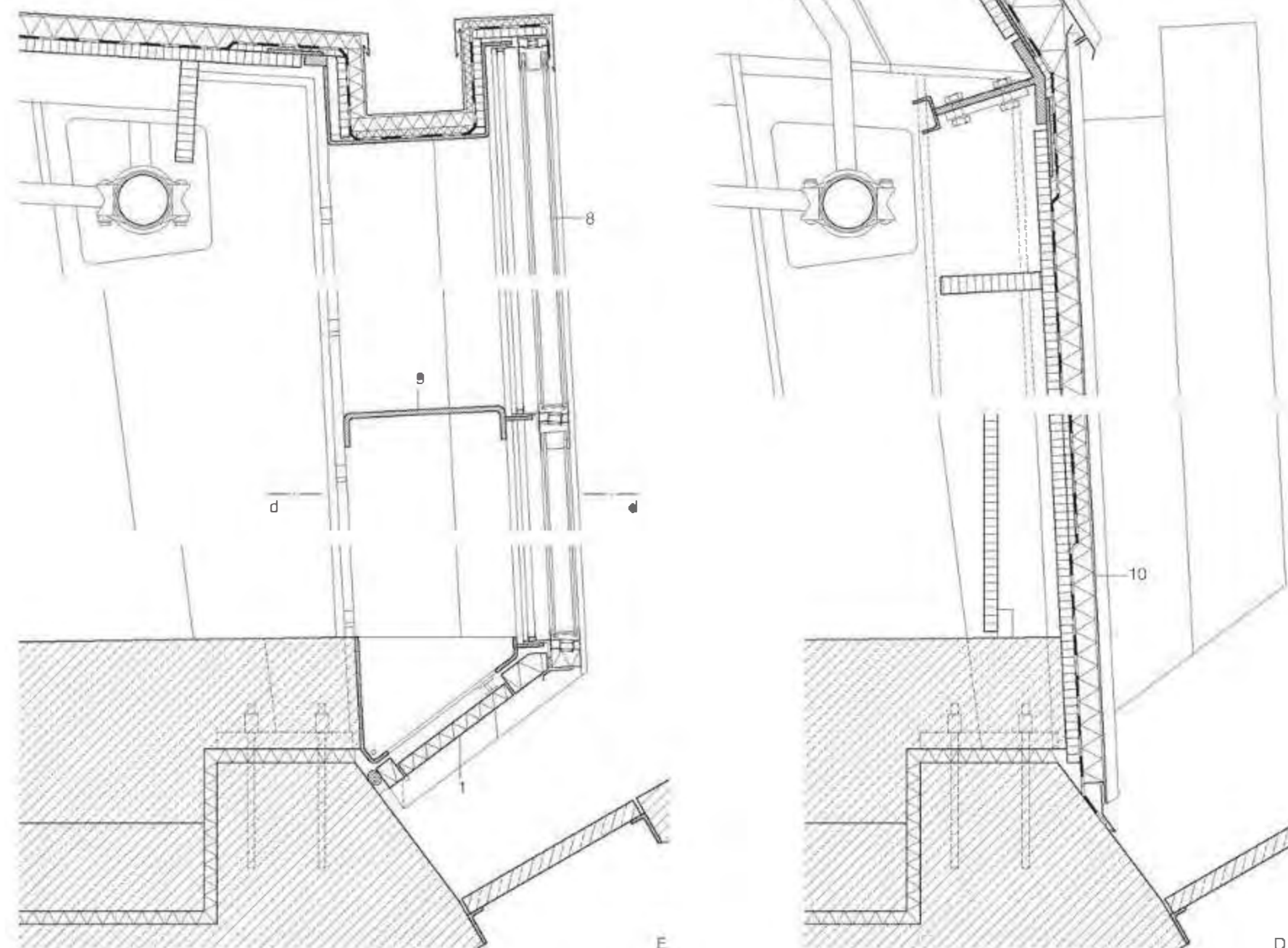
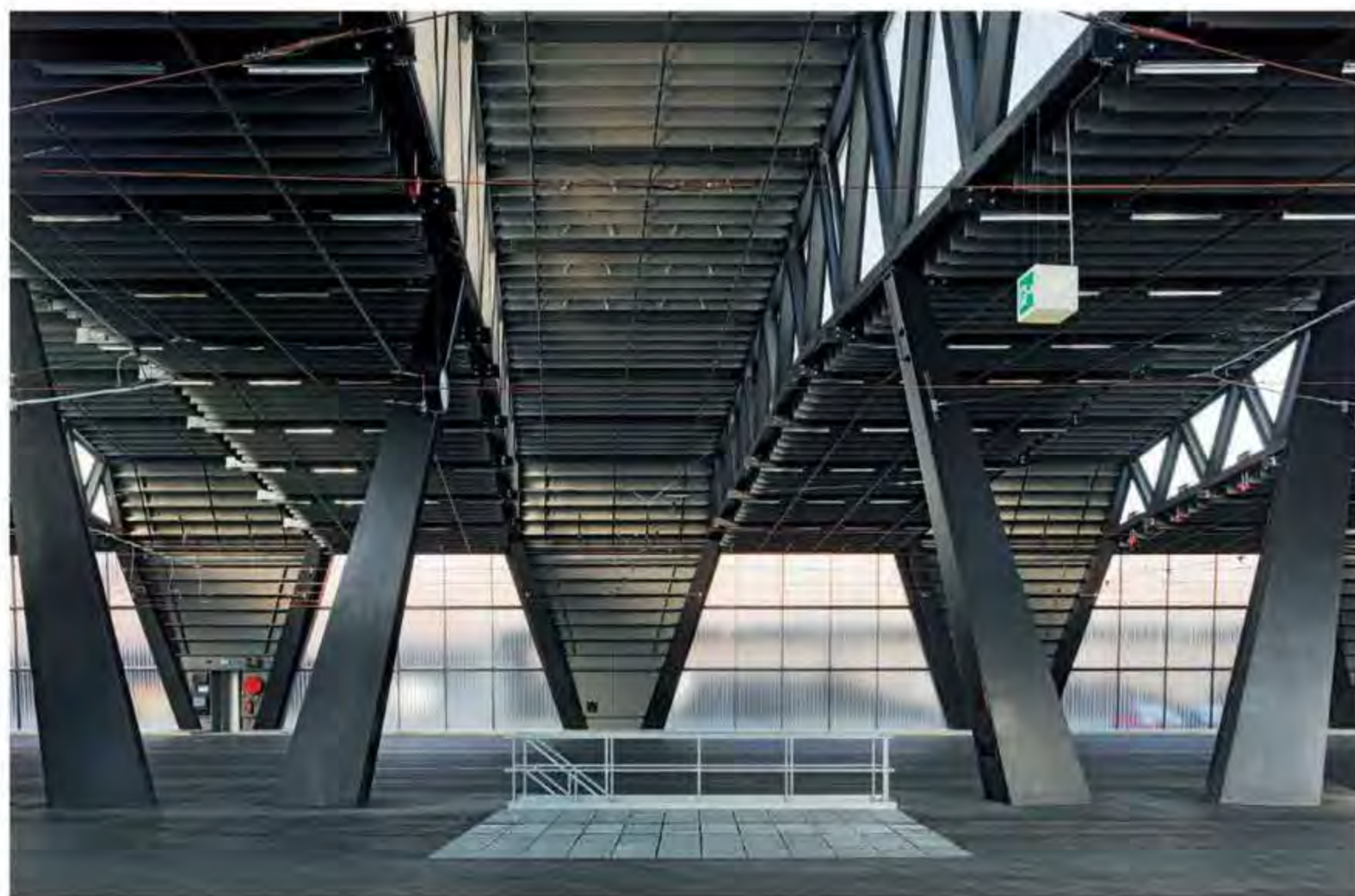


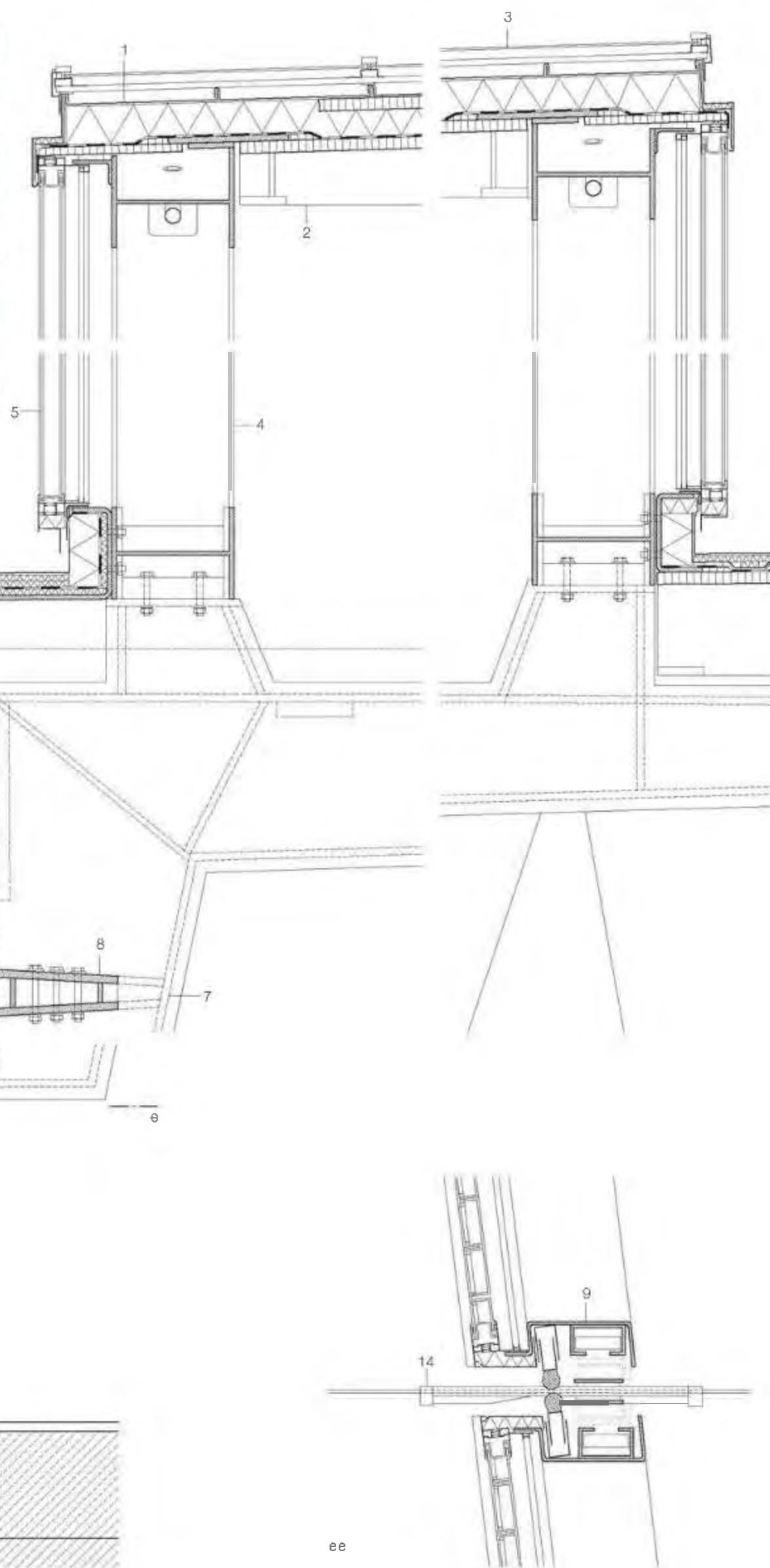


Vertical sections
scale 1:20

Isometric of structure:
standard segment

- | | | |
|---|--|---|
| 1 smoke- and heat-extract:
40 mm insulated sheet
aluminium sandwich panel | 5 welded from steel flats, rigidly
bolted to trussed girder max. height
approx. 9 m:
300/500 mm I-sections
welded from steel flats | channel section |
| 2 1 mm sheet aluminium with
friction joints | 6 sprinkler run | 10 1 mm sheet aluminium with
friction joints |
| 60-200 mm mineral-wool
thermal insulation | 7 photovoltaic module | 60 mm mineral-wool
thermal insulation |
| sealing layer, adhesive fixed | 8 2x 32/60/7 mm profiled
glass sections | vapour barrier |
| 39 mm laminated timber sheeting | 9 480/100 mm bent steel | 39 mm laminated timber
sheeting |
| 3 51/300 mm laminated timber ribs | | 200 mm services duct |
| 4 140/310 mm T-section | | 30 mm laminated timber
sheeting |

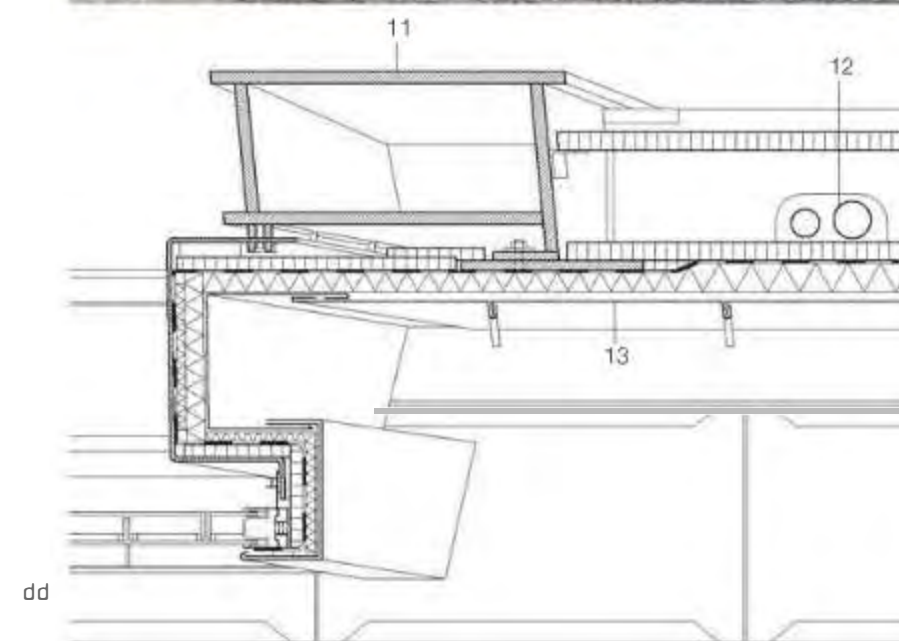




ee



Vertical and horizontal sections
through lifting gate
Horizontal section through long facade
scale 1:20



dd

- | | |
|---|---|
| 1 1 mm sheet aluminium with friction joints | 8 cross-bracing to lifting-gate supporting frame: welded steel box section from 12–25 mm sheets |
| 2 51/300 mm laminated timber | 9 gate surround: 420/110 mm steel section bent to shape |
| 3 photovoltaic module | 10 30 mm asphalt |
| 4 rigid trussed girder max. height approx. 9 m: 300/500 mm I-sections welded from steel flats | 11 box-section column: 25 mm welded steel plates |
| 5 2 x 32/60/7 mm profiled glass sections | 12 electric cable run |
| 6 operating cable with pulley | 13 1 mm sheet aluminium with friction joints |
| 7 suspended lifting-gate support: welded steel box section from 12–50 mm sheets | 14 fixing for conductor line |
| | 100 mm thermal insulation |
| | vapour barrier |
| | 38 mm laminated timber sheeting |
| | 200 mm services duct |
| | 38 mm laminated timber sheeting |



Museum of the Bavarian Kings in Hohenschwangau

Architects:

Staab Architects, Berlin

Contract management:

Rustler Schmid Architects, Friedberg

Structural planners:

IFB Frohlof Staffa Kühl Ecker, Berlin

Baithel and Maus, Munich

Others involved in the project: see page 677



Site plan
scale 1:10,000

Section

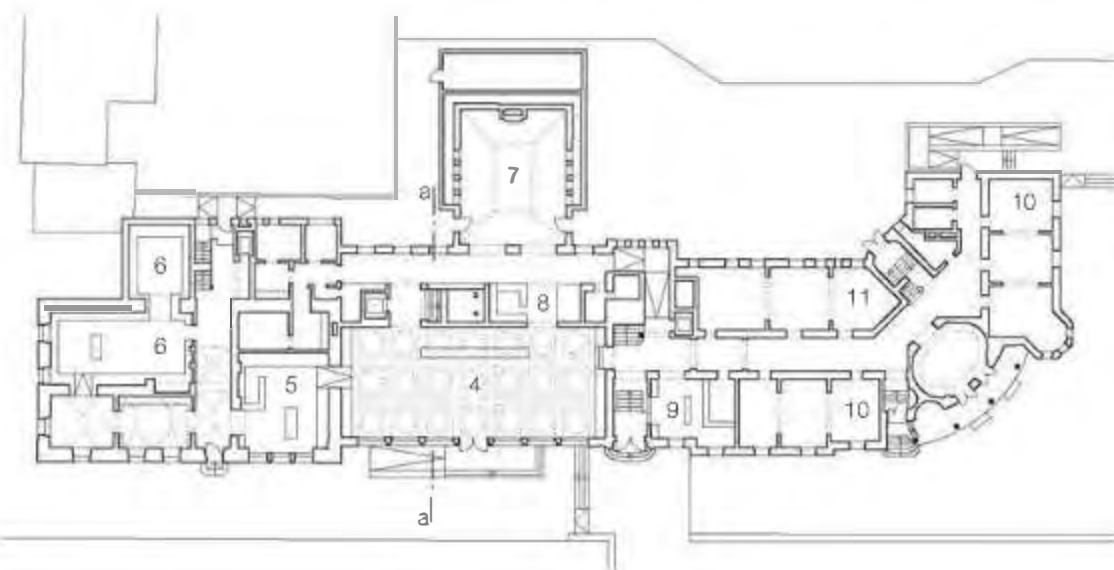
scale 1:500

Floor plans

scale 1:750

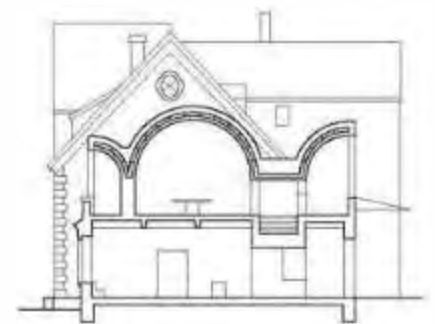
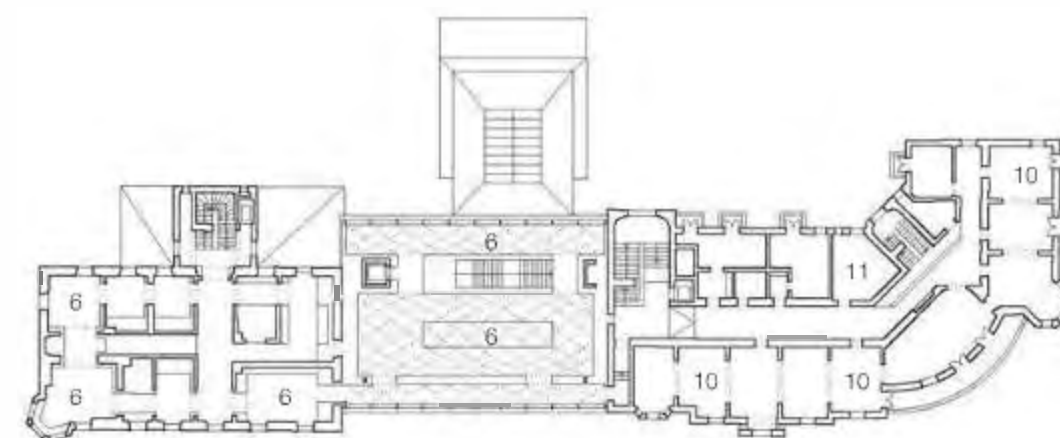
1 Museum of the
Bavarian Kings
2 Hohenschwangau
Palace

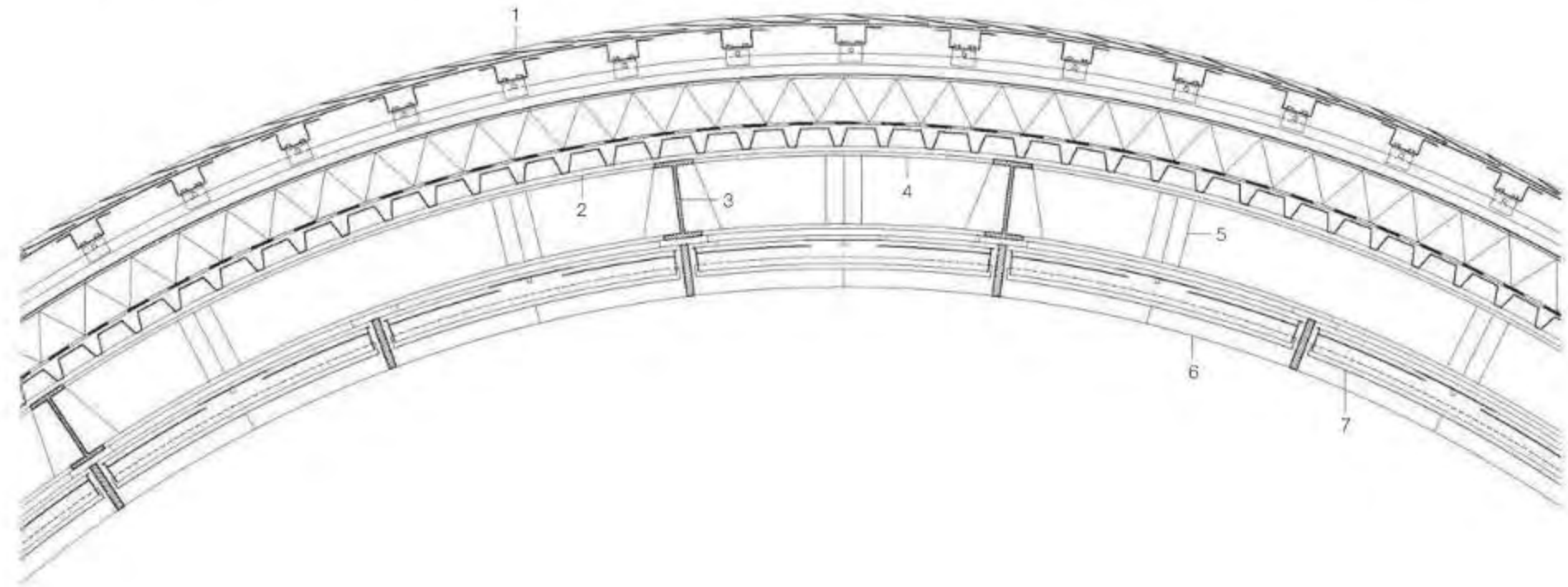
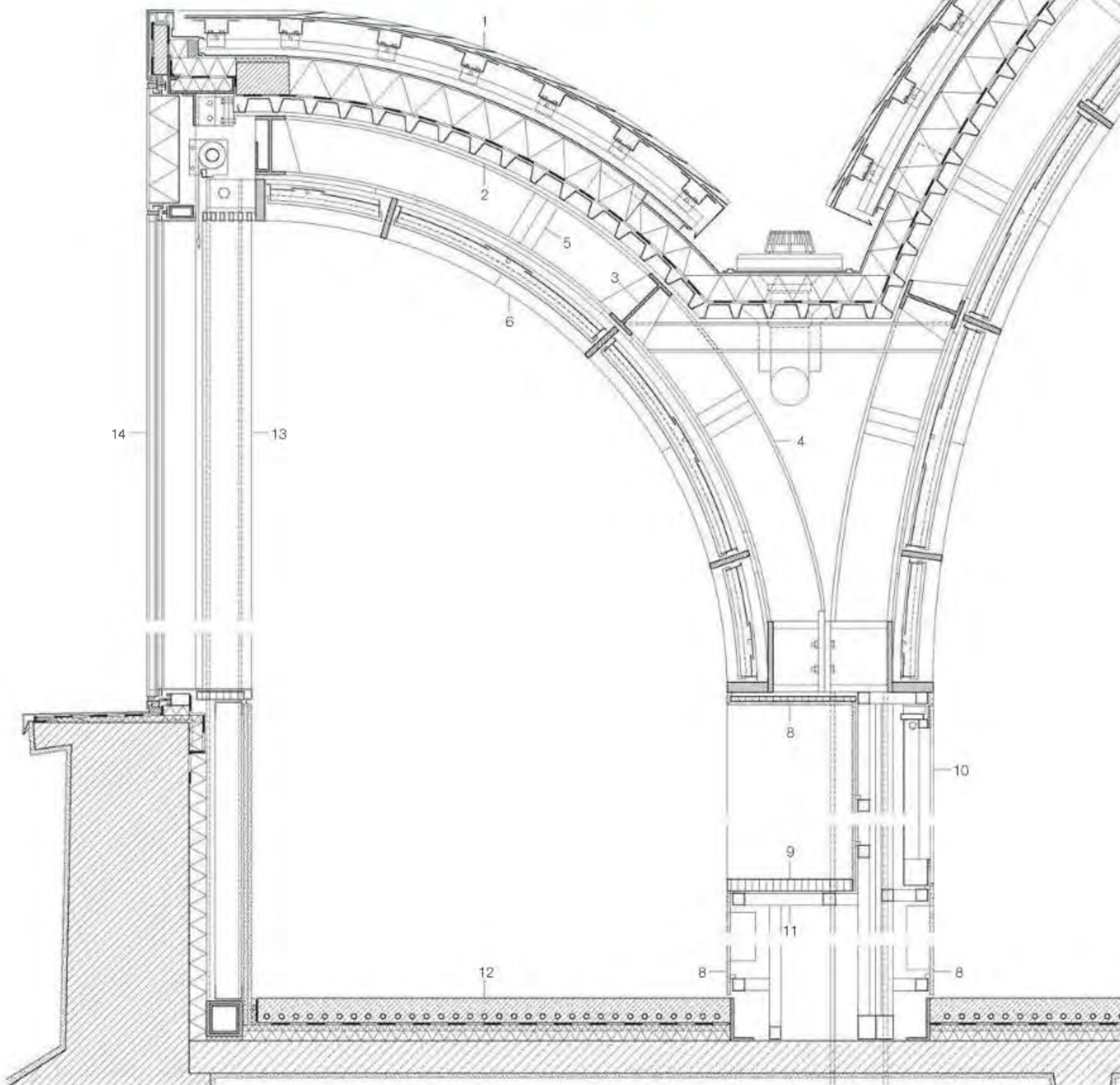
3 Alpsce
4 Foyer
5 Museum shop
6 Exhibition spaces
7 Space for special
events
8 Cloakroom
9 Reception area
10 Gastronomy
11 Kitchen



Despite its location directly on the Alpsce and close to two Bavarian royal palaces, the Hotel Alpenrose had stood empty for many years, scarred as it was by conversions and additions. Today, luxuriously converted, it awaits a new operator. In the process of refurbishing the listed ensemble to house the Museum of the Bavarian Kings, a structure was created over the former dining hall to link the hotel with the hunting lodge. Now converted into a museum foyer, the hall serves as a distribution zone between the exhibition spaces and the gastronomic areas of the hotel. The jury was quickly convinced by Volker Staab's competition entry. The vaulted roof spans the difference between old and new with modern restraint as well as congenial ornamentation. Beneath the central barrel vaulting of the three-bay layout is a realm that provides ideal conditions for the exhibits, shielding them from direct sunlight. The two side bays, on the other hand, open on to the landscape, affording views of the palaces and the lake. The interior is dominated by the grid-like structure of the lattice-shell roof – inspired by the Bavarian flag. In every rhomboid, LEDs create points of illumination behind PETG panes, ensuring diffuse lighting and a pleasant atmosphere. The museum's fine inbuilt elements in bronze-coloured mineral-based material

and the sensitive treatment of the old structure make a tour through the history of the House of Wittelsbach a delightfully sensuous experience. With an eye to the neighbouring palaces of Hohenschwangau and Neuschwanstein, attention is focused on Kings Maximilian II and Ludwig II – father and son – who occupy positions opposite each other in the central vaulted hall. The lattice-shell ceiling of the hall was delivered in five segments, while the two quarter-vaults at the sides were prefabricated as single elements. These three approximately 21-metre-long sections are borne by internal reinforced concrete columns and walls and by steel facade columns. Behind the simply curved barrel vaulting is a complex load-bearing structure: the lower shell, with its visible rhomboid-grid, is formed by lasered flat-steel bearers welded according to the Zollinger principle. The load-bearing capacity is attained in conjunction with the purlin layer above, which consists of I-beams spanning in the longitudinal direction. Only in the edge bays do the purlins abut the curved, transverse I-beams, which are fitted with ties. Flat-steel members welded to the purlins and elevated in the intermediate spaces bear the trapezoidal-section sheet-metal covering and insulation. The roofing – anodized-aluminium tiling in various red tones – is visible from the palaces.





Vertical section
scale 1:20

- | | | | |
|--|--|---|--|
| 1 aluminium tiles anodized in red tones with concealed riveting | 2 120/16 mm steel flat bearer | LED fitting | separating layer |
| 3 200 mm steel I-section purlins fixed longitudinally | 3 200 mm steel I-section purlins fixed longitudinally | 1 mm sheet aluminium | 20 mm impact-sound insulation |
| 4 200 mm steel I-sections fixed laterally (only at edge of vaulting) | 4 200 mm steel I-sections fixed laterally (only at edge of vaulting) | 8 12 mm acrylic-based mineral material | 35 mm levelling layer |
| 5 10 mm sheet-metal gussets as distance pieces | 5 10 mm sheet-metal gussets as distance pieces | 9 40 mm medium-density fibreboard seat veneered with smoked oak | existing reinforced concrete |
| 6 140/15 mm flat-steel bearers forming grid according to Zollinger principle | 6 140/15 mm flat-steel bearers forming grid according to Zollinger principle | 10 11 mm laminated safety glass showcase, rear-lighted | 13 100/50 mm steel RHS facade column with 2 mm polished stainless-steel cladding |
| 7 lighting recess: 1.5 mm satin-finished PETG | 7 lighting recess: 1.5 mm satin-finished PETG | 11 40/40 mm aluminium SHS tube | 14 2x 4 mm laminated safety glass + 16 mm cavity + 6 mm toughened safety glass ($U_g = 1.1 \text{ W/m}^2\text{K}$) |
| | | 12 85 mm polished screed with heating/cooling runs | |

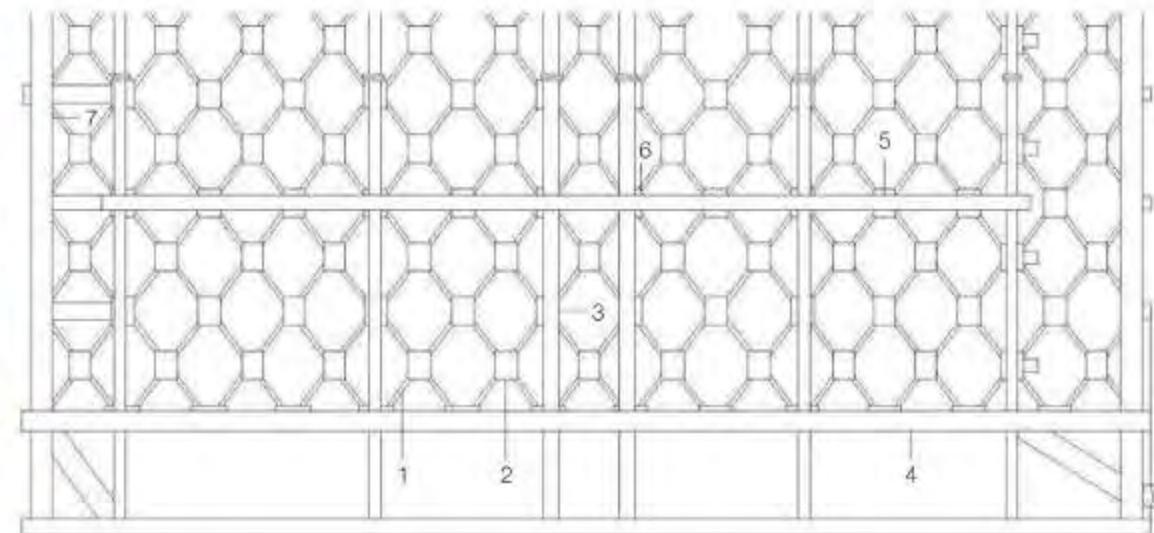
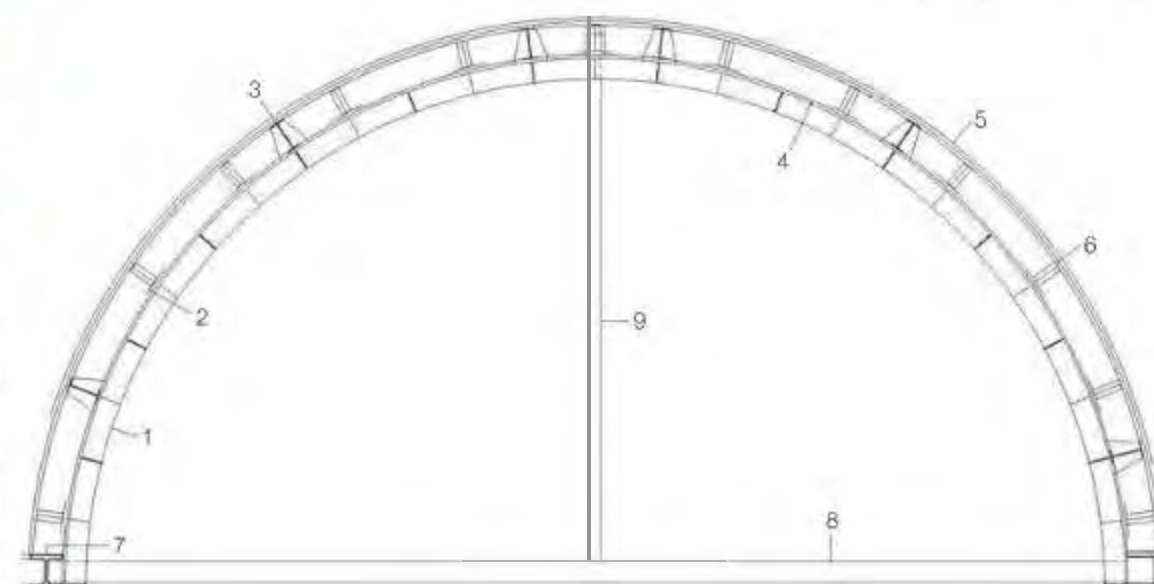
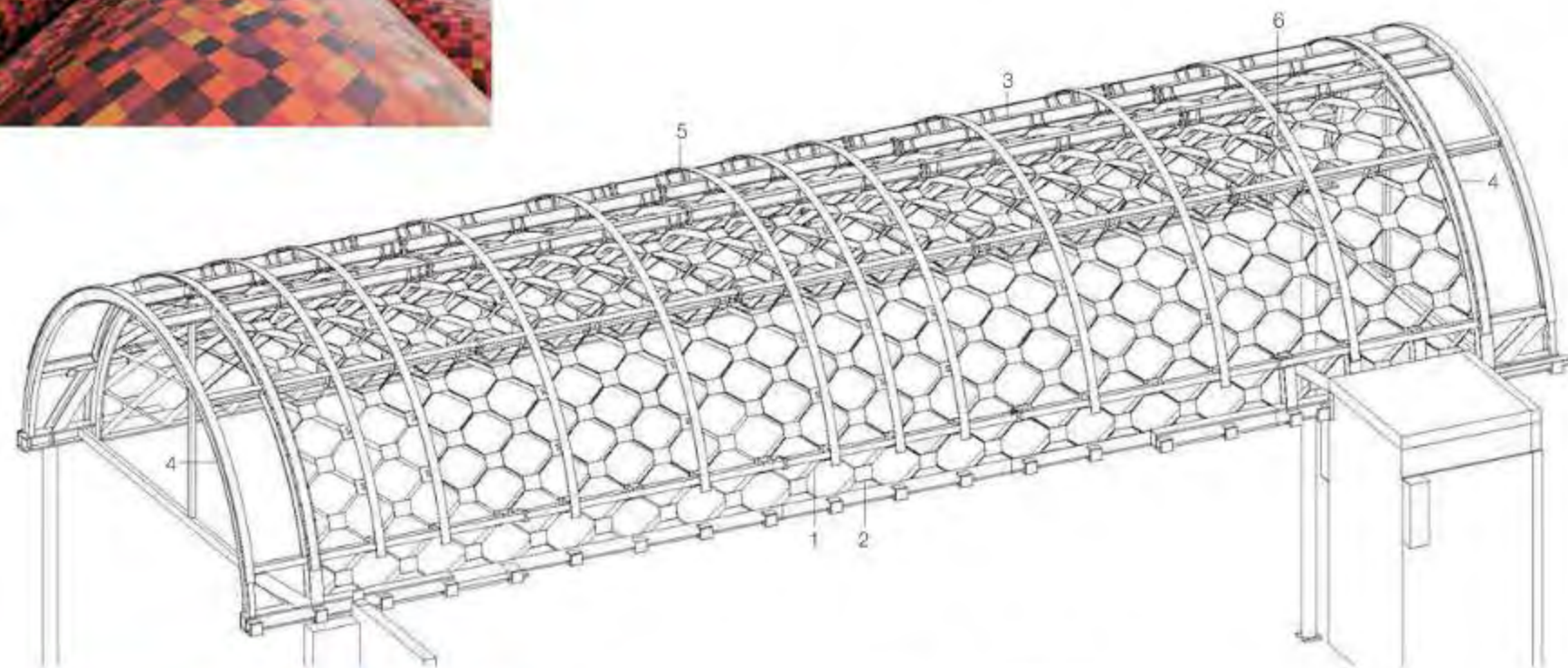




- 1 140/15 mm steel-flat bearers former grid according to Zollinger principle
- 2 5 mm metal mounting plate for fixing soffit
- 3 200 mm steel I-section purlins, fixed longitudinally
- 4 200 mm steel I-sections fixed laterally (only at edge of vaulting)

- 5 120/16 mm steel-flat bearers for trapezoidal-section sheeting
- 6 10 mm sheet-metal gussets as distance pieces
- 7 200 mm steel I-section edge beam
- 8 140/80 mm steel RHS (only at edge of vaulting)
- 9 Ø 80 mm steel SHS tube

Isometric of steel structure
Diagrammatic section
Top view



King's Cross Station in London

Architects:

John McAslan + Partners, London

John McAslan, Hiro Aso

Simon Goode, Pauline Nee

Team:

Mark Bell, Allan Dor, Louise Hanson, David

Jackson, Dean Kirkwood, Michael Mason,

Aidan Potter, Sascha Stscherbina, Philip

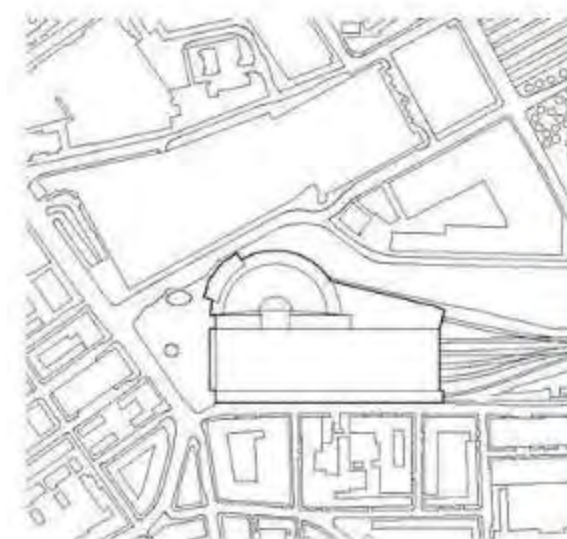
Veall, Jasmine Wadia, Katherine Watts

Structural engineers:

Arup, London

Others involved in the project: see page 677

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Site plan scale 1:10000

Since its completion in 1852, London's King's Cross Station has been one of the capital's most important railway termini. Created by Lewis Cubitt in Victorian style and now functioning in conjunction with an underground station for six lines, as well as the neighbouring St Pancras main-line station, King's Cross forms a much frequented node in the public transport system of the city.

In view of the fact that Cubitt's original structure had long been unable to cope properly with the growing number of passengers, the building client, Network Rail, decided to modernize the station. As early as 1998, the architects had drawn up an urban master plan in conjunction with Ove Arup. This foresaw moving the new station hall to the west and in the first instance creating a design with departing passengers in mind.

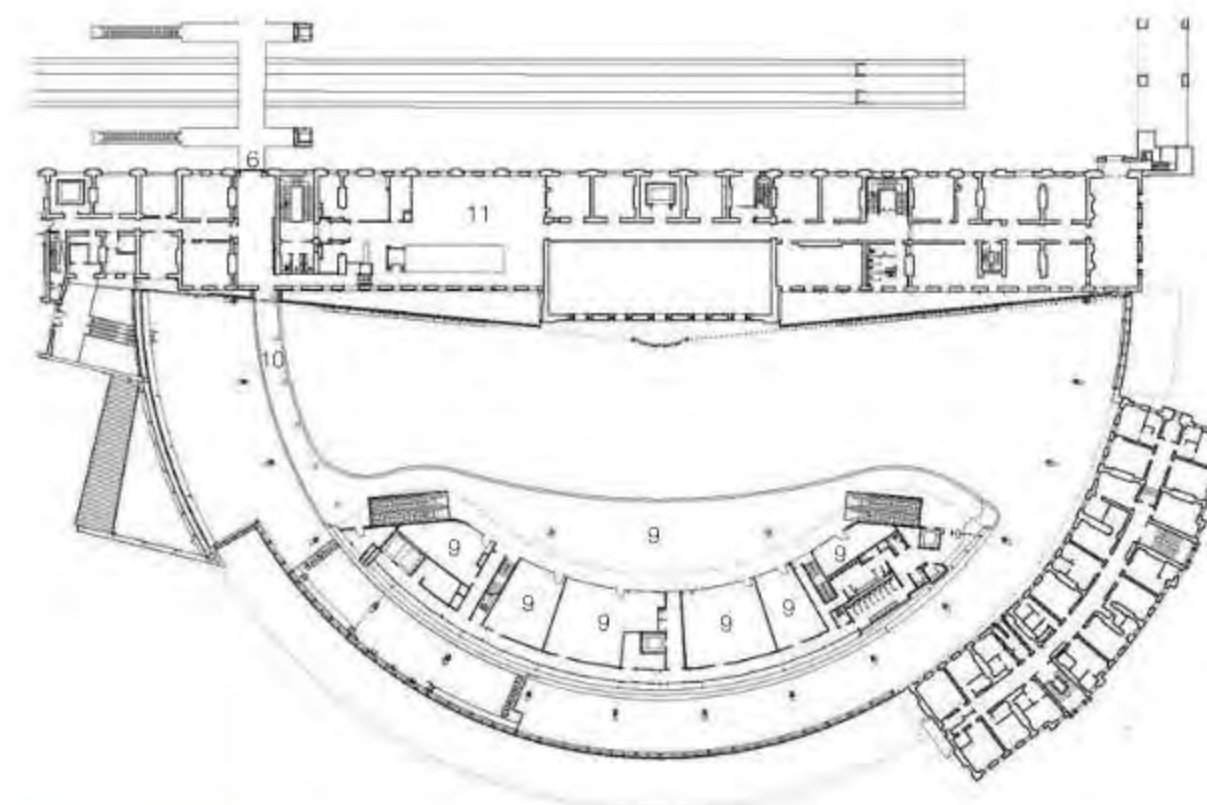
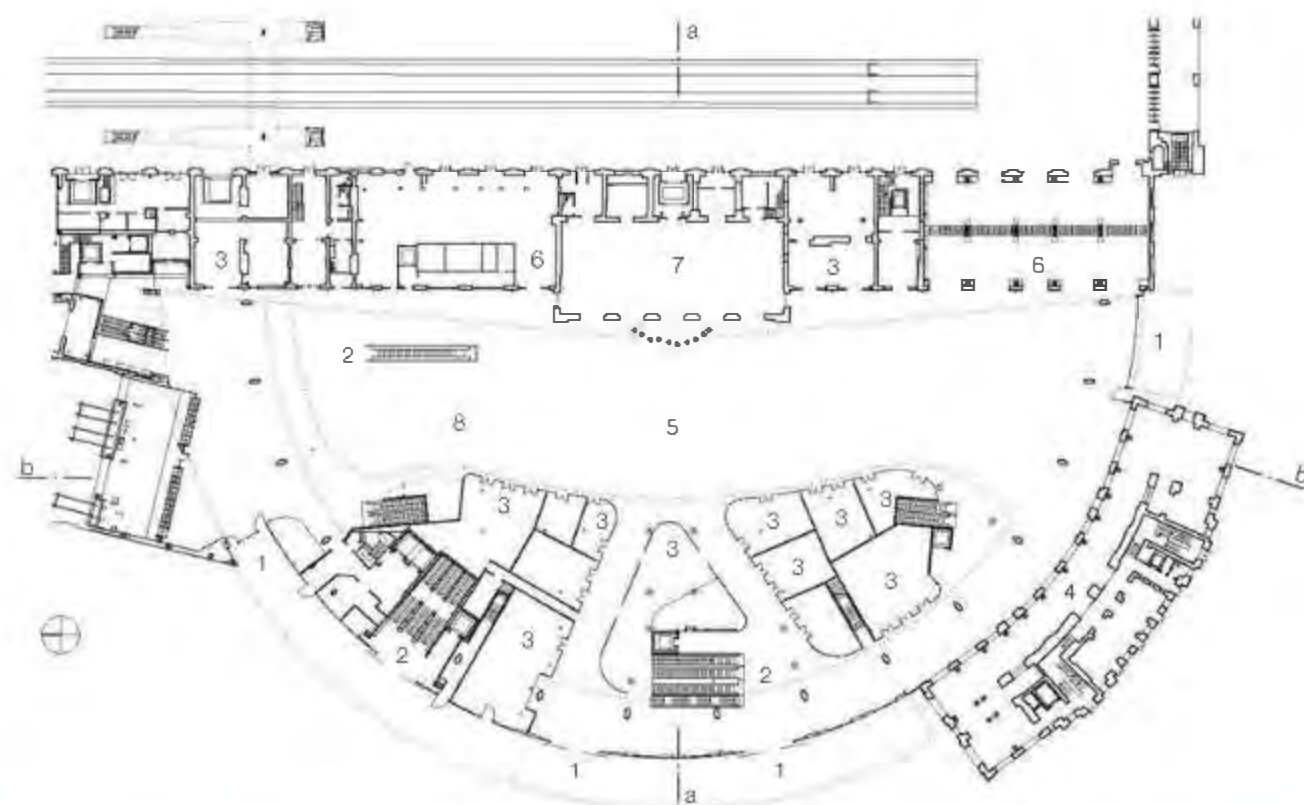
The new Western Concourse is impressive for its filigree, white load-bearing lattice structure. A volume has been inserted in which shops and restaurants have leased a presence. The ticket offices are situated opposite in the west wing. Here, the old listed building has been carefully restored to its original form. In front of its brick facade, a white steel lattice structure grows from the ground, branching out as it rises to form the curved roof. The whole is covered with aluminium panels and areas of glazing at the edges, through which light can enter and one catches glimpses of the Cubitt facade.



- 1 Western Range building
- 2 Western Concourse

- 3 Great Northern Hotel
- 4 St Pancras International



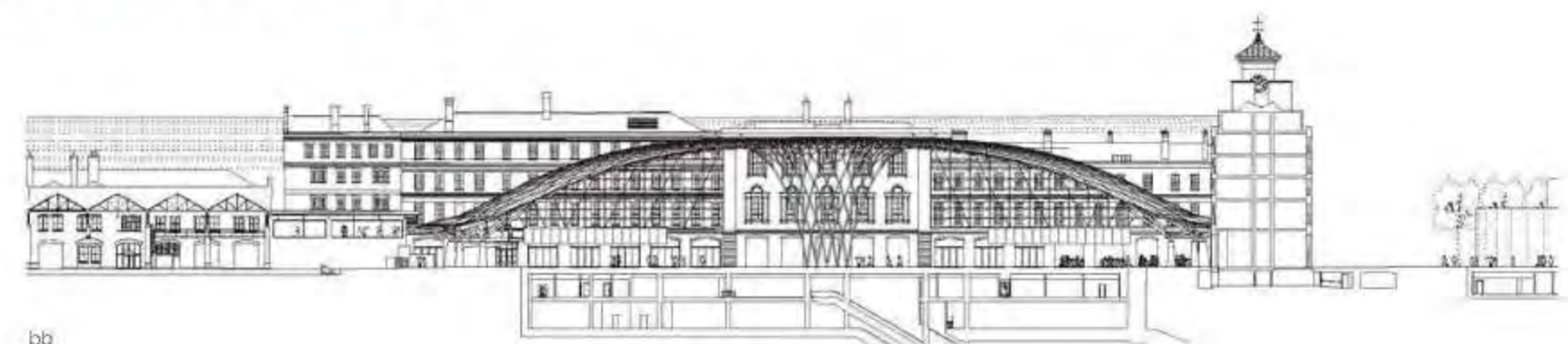
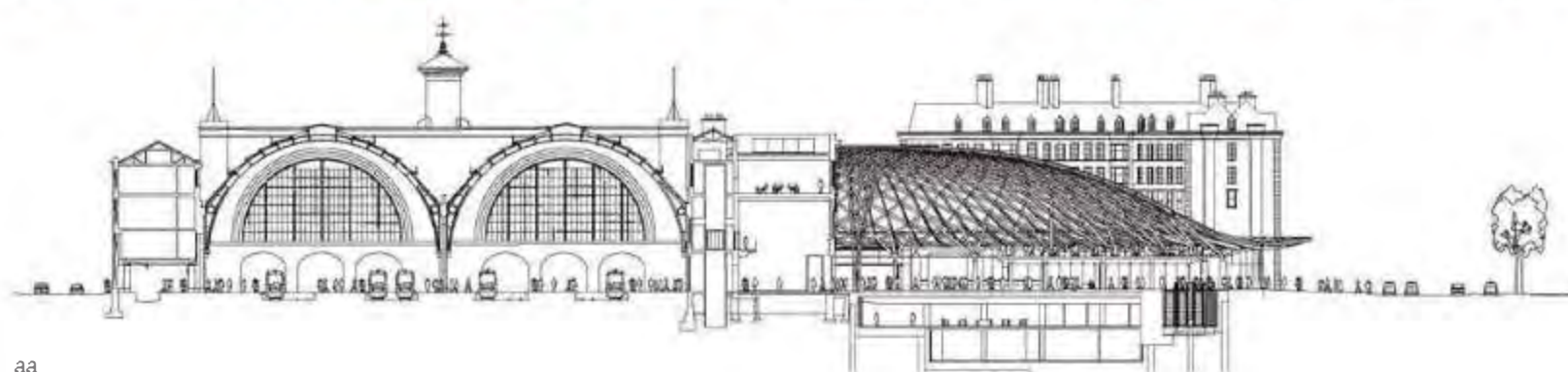


The complex constructional situation called for a close collaboration with the structural engineers from the very beginning of the design. So many built volumes exist below ground – like the northern ticket hall of the London Tube station – that space for new foundations was restricted to only a few locations. Nor was it possible to transmit loads to the adjoining Western Range structure. The solution for the erection of a roof over the 7,500 m² area of the Western Concourse was found in the creation of a free-standing, rigid half-dome: a steel structure with a radius of 60 m, consisting of radial box girders and diagonal tubes. Since the semicircular lattice shell describes an S-shaped curve in section, shear forces are conducted away from the facade of the existing building. They are all the greater, however, in the area of the curved edge of the roof structure, where it is borne by 16 piers that reach upwards in tree-like fashion, each with four branches supporting the lattice-grid at node points. The piers bear loads of up to 600 tonnes, which are transmitted to the ground via newly bored piles and the enclosing walls of the Tube structure beneath the station. Standing centrally in front of the existing building is a funnel-like column into which the lattice-shell roof flows. Every other radial

box girder terminates at the upper end of the funnel. Here, the outer aluminium covering gives on to a semicircular glazed roof. The remaining girders come to an end as the funnel becomes increasingly slender downwards. An arched edge beam forms a relatively rigid conclusion to the lattice shell next to the existing structure. Suspended from this beam is a glass-louvre facade, which serves the needs of natural lighting and ventilation in the hall. In view of the relatively light weight of the steel roof structure, it was possible to install large prefabricated sections of the lattice shell by crane. This considerably reduced the amount of on-site welding as well as the assembly time, which in turn simplified the construction logistics and helped to avoid any interruptions to train services.

Plans • Sections scale 1:1250

- 1 Entrance
- 2 Underground entrance
- 3 Shops
- 4 Hotel
- 5 New concourse
- 6 Access to platforms
- 7 Tickets
- 8 Information
- 9 Restaurants
- 10 Pedestrian bridge
- 11 First-class lounge

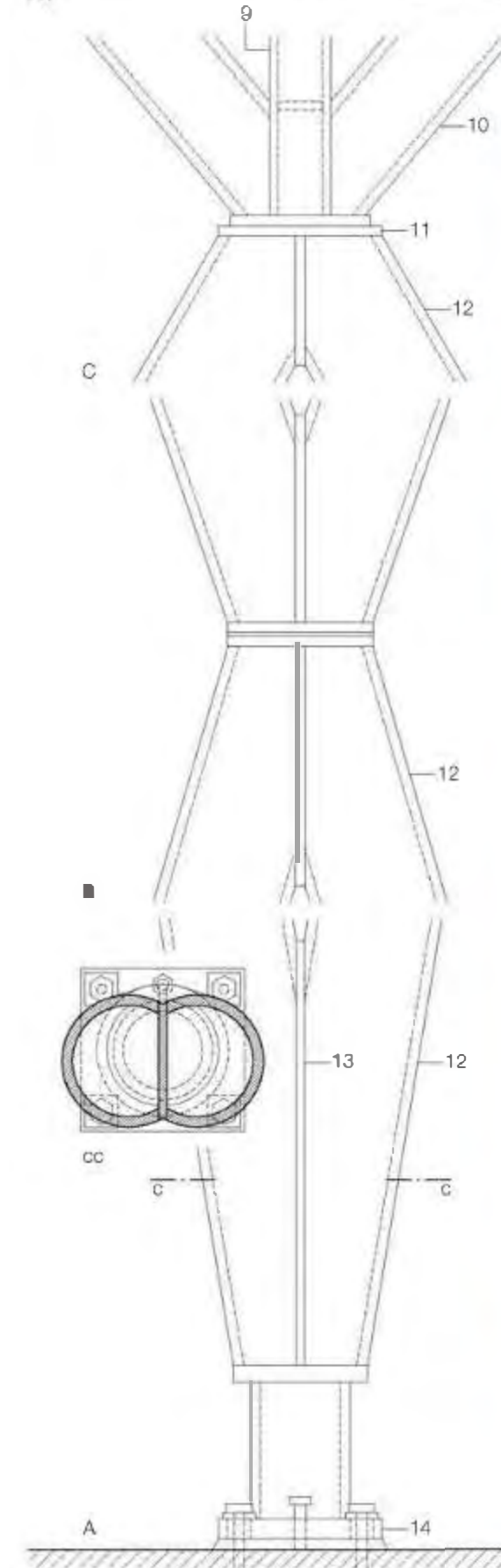
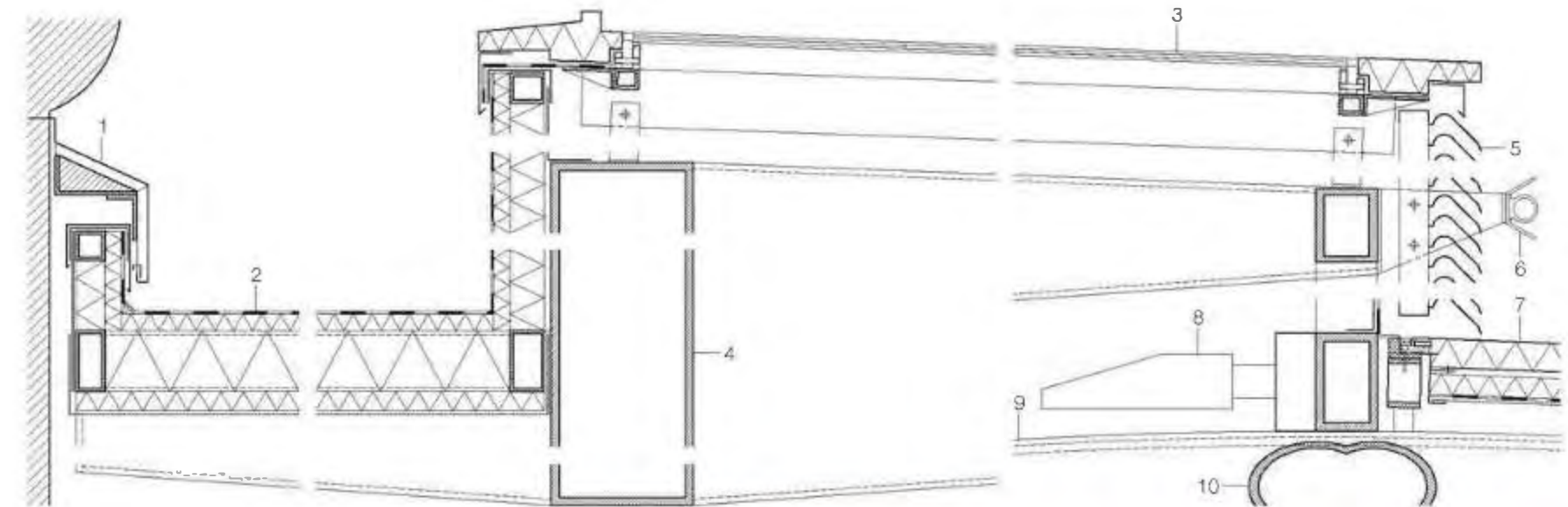
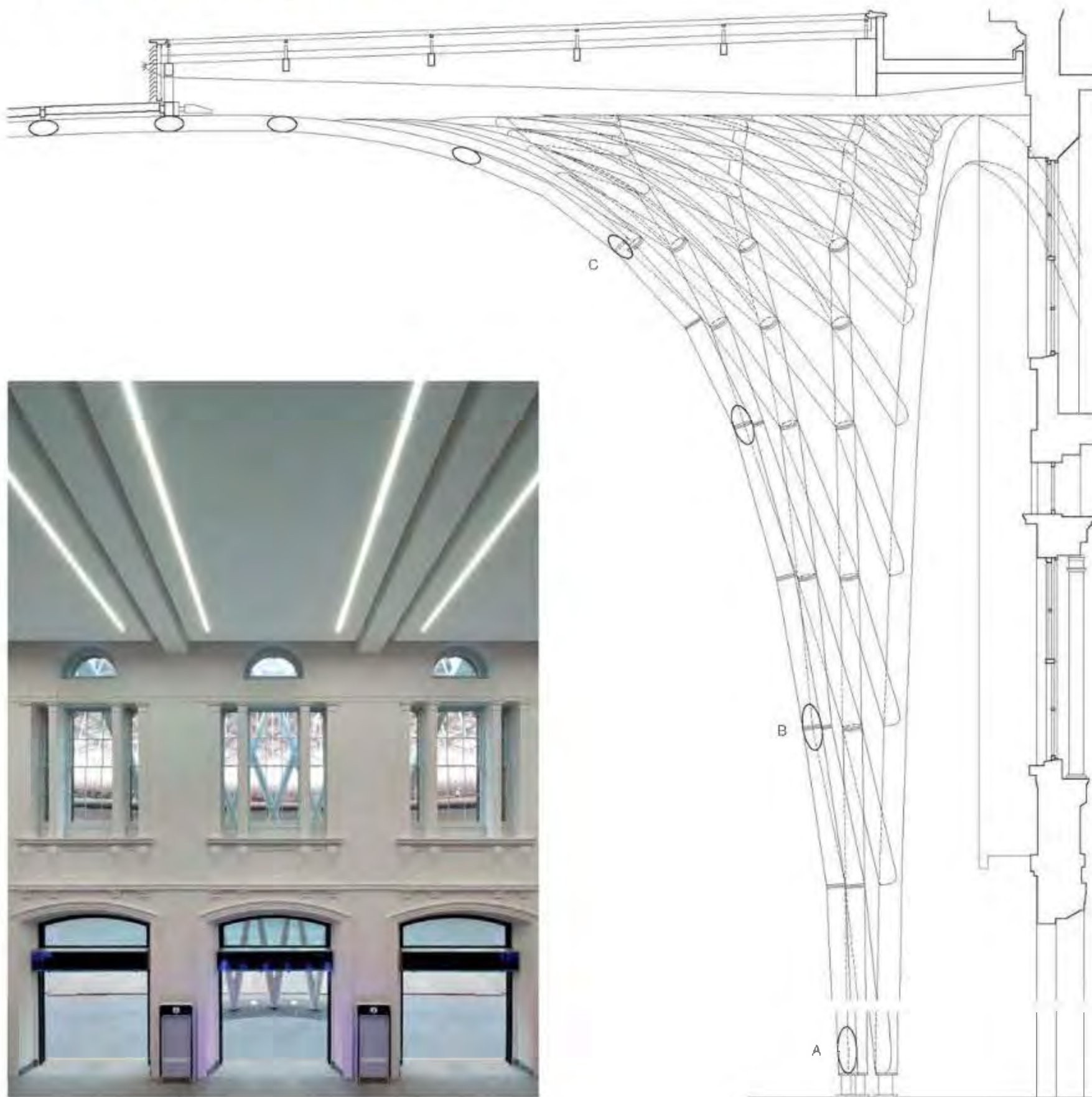


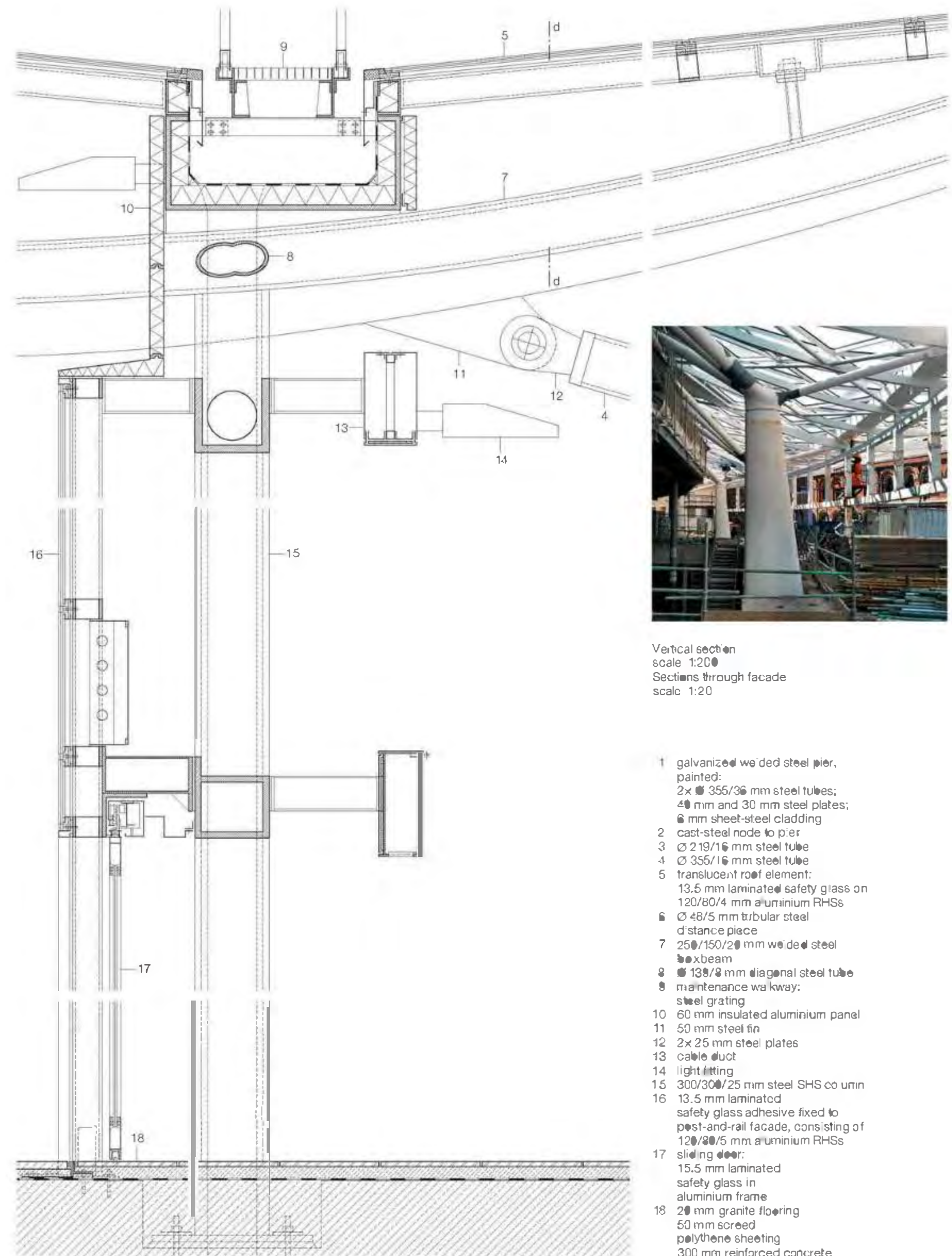
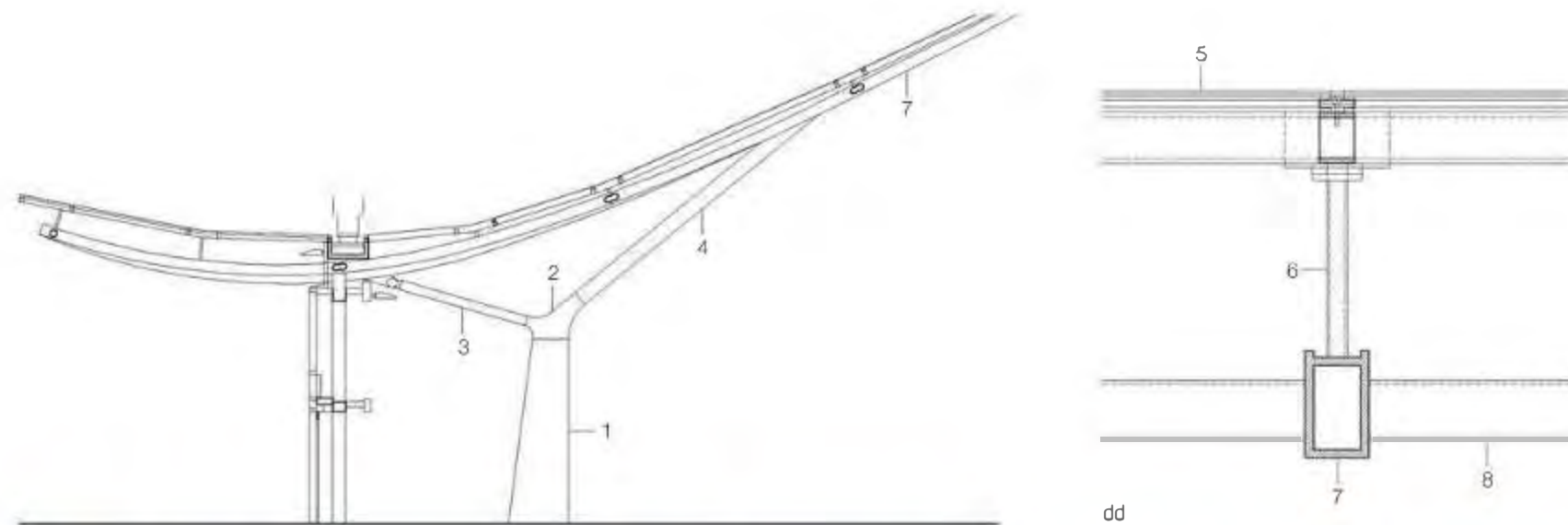


Vertical section
scale 1:100
Section through facade
Load-bearing structure
scale 1:20

- 1 2 mm sheet-aluminium flashing to existing building
- 2 bituminous sheet sealing layer
20 mm EPS insulation,
compression resistant
160 mm mineral-wool insulation
between 80/120/5 mm steel
RHS supporting structure
- 3 13.5 mm laminated
safety glass roof light
- 4 250/800/20 mm galvanized
steel RHS, painted

- 5 stainless-steel ventilation grille
- 6 fall prevention rail
- 7 opaque roof element:
2.5 mm anodized-aluminium
sheeting
70 mm mineral wool
3 mm galvanized steel sheeting
50 mm mineral wool
vapour barrier
2 mm perforated
aluminium sheeting
- 8 light fitting
- 9 150/250/20 mm welded
steel box beam
- 10 Ø 244/25 mm galvanized
diagonal steel tube,
painted
- 11 25 mm steel plate
- 12 Ø 323/25 mm steel tube
- 13 20 mm steel plate
- 14 400/400/50 mm steel plate





National Stadium in Warsaw

Architects:

Planning consortium consisting of:

gmp – Architects von Gerkan, Marg und Partner, Berlin

JSK Architects, Warsaw

schlaich bergmann und partner, Stuttgart

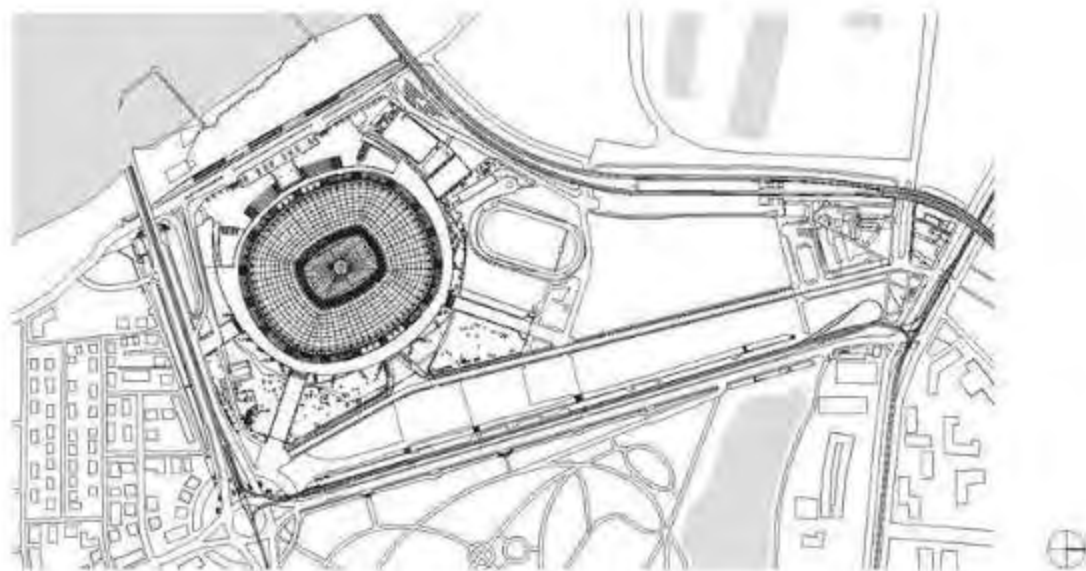
Others involved in the project: see page 677

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The new Polish National Stadium stands on the former earthworks of the Dziesciolecia Stadium, which was erected in 1955 from the rubble of the Second World War. It is situated on the River Vistula roughly two kilometres from the city centre and is surrounded by green spaces, sports areas and trees. One condition imposed by the city was that the existing debris should be built upon with as little intrusion as possible. The new structure, with its two lower storeys, was, therefore, integrated into the existing topography of the site, without changing the level of the crown of the mound or that of the existing playing field. As a result, it was possible to retain former routes, the geometry of

the earth filling and two access tunnels. The duality of the solid historical stone plinth and the new structure, consisting of steel, glass and a Teflon membrane, which becomes visible externally only from the crest of the mound, lends this football stadium for 55,000 spectators an unmistakable identity. The facade, consisting of expanded-metal panels in the Polish national colours of red and white, makes its own contribution in this respect. The enclosure, with its translucent quality, is meant to recall a woven basket and unites the many different areas within the stadium into a single large form. To ensure an all-year use of this development, extensive areas are foreseen for func-

tions other than sporting events and concerts, including offices and conference spaces, a museum, restaurants and a health club. Access to the office areas will be via eight individual staircases and lifts, so that the approximately 400 m² units can be leased out separately. During the European Championships, they were used by the media and the UEFA. Subsequent changes of use that necessitate modifications of the thermal facade behind the translucent layer will not be visible from the outside and will have no effect on the overall architectural form. Year-round use will be ensured by a closable roof, consisting of membrane sails. This element of the construction is unique in

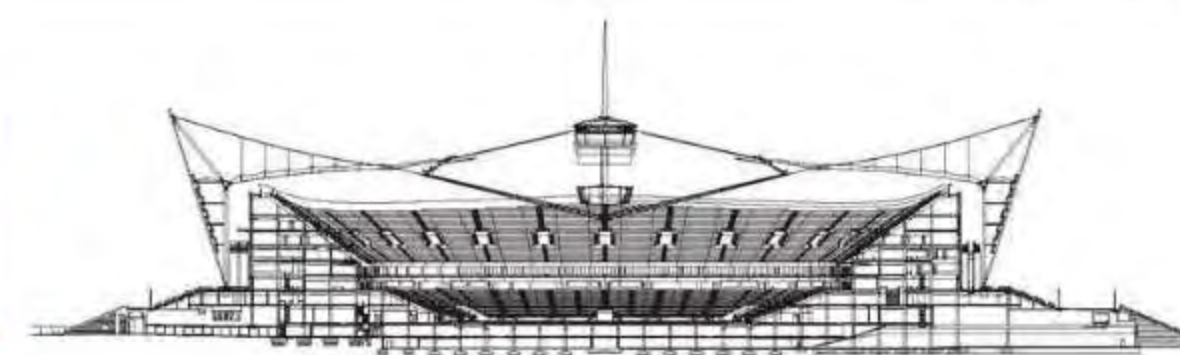


Europe. It is designed to meet loads resulting from snow thicknesses of up to 18 cm. Below the playing field and the stands, roughly 1,800 parking spaces help to ensure that the stadium remains a multifunctional arena; for even after the European Championships, the structure should continue to be a practical, urban-planning enrichment for the capital city of Poland.

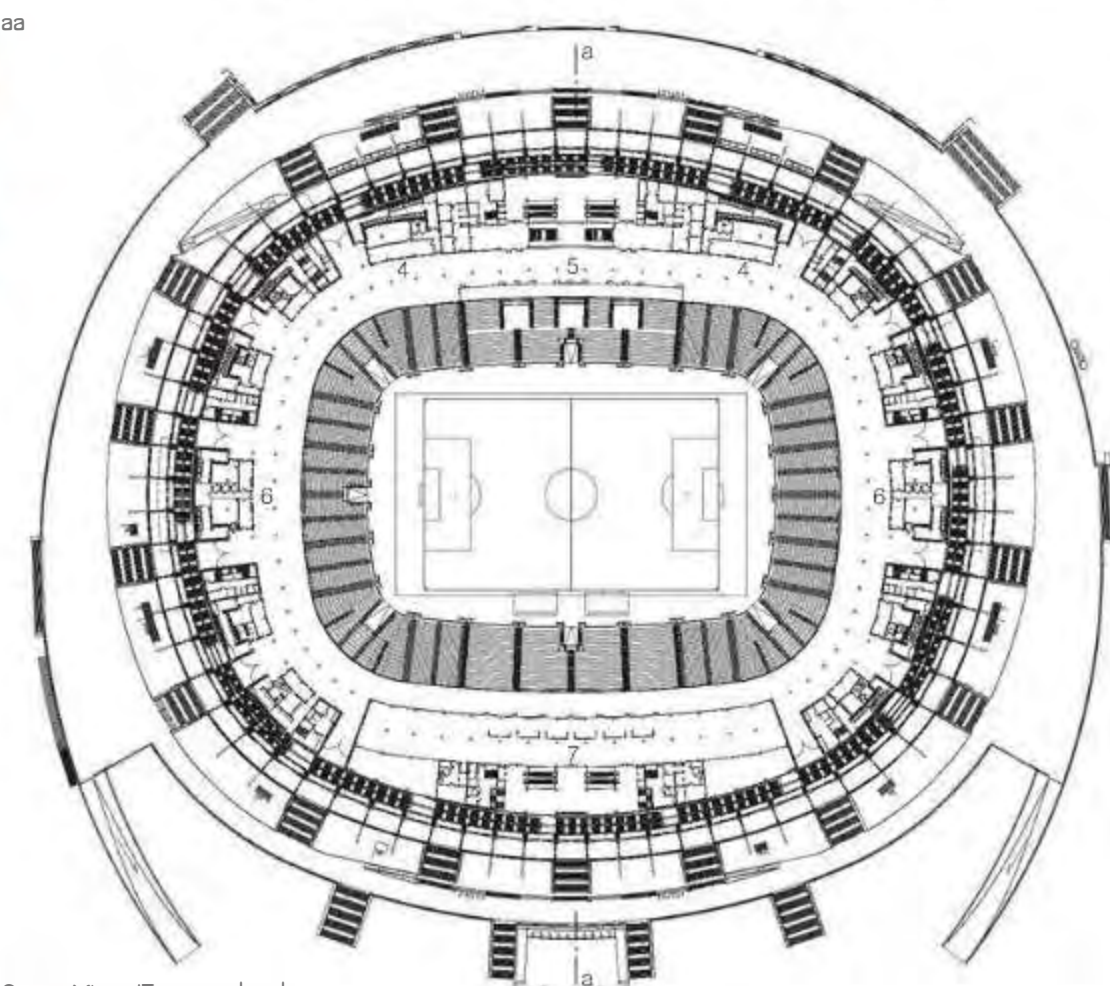
Site plan
scale 1:15,000

Section
Plans
scale 1:3000
1 Museum

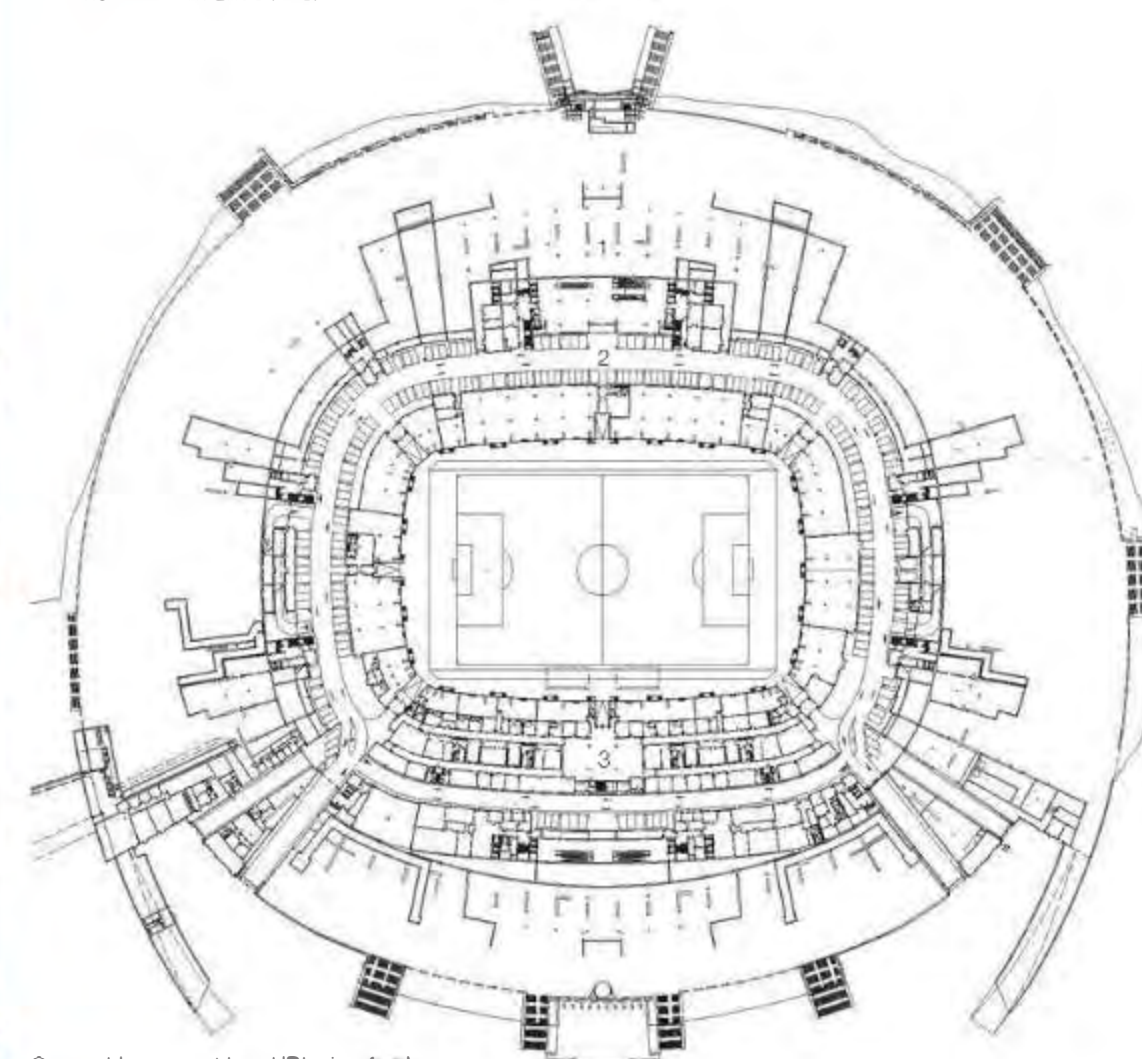
2 Parking
3 Mixed zone/
Players' area
4 Kiosk
5 Lower fan circulation
6 WCs
7 Business club



aa

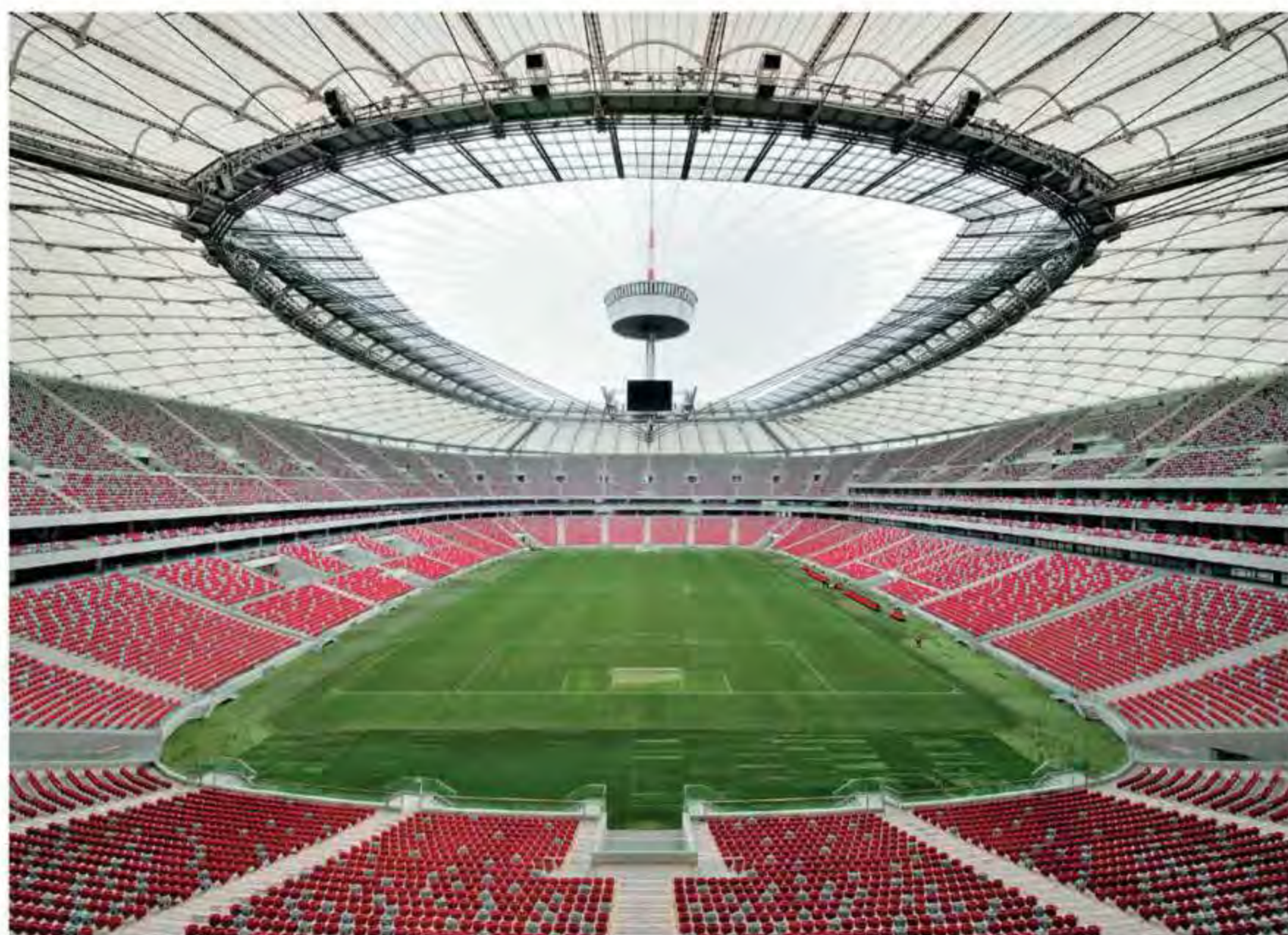
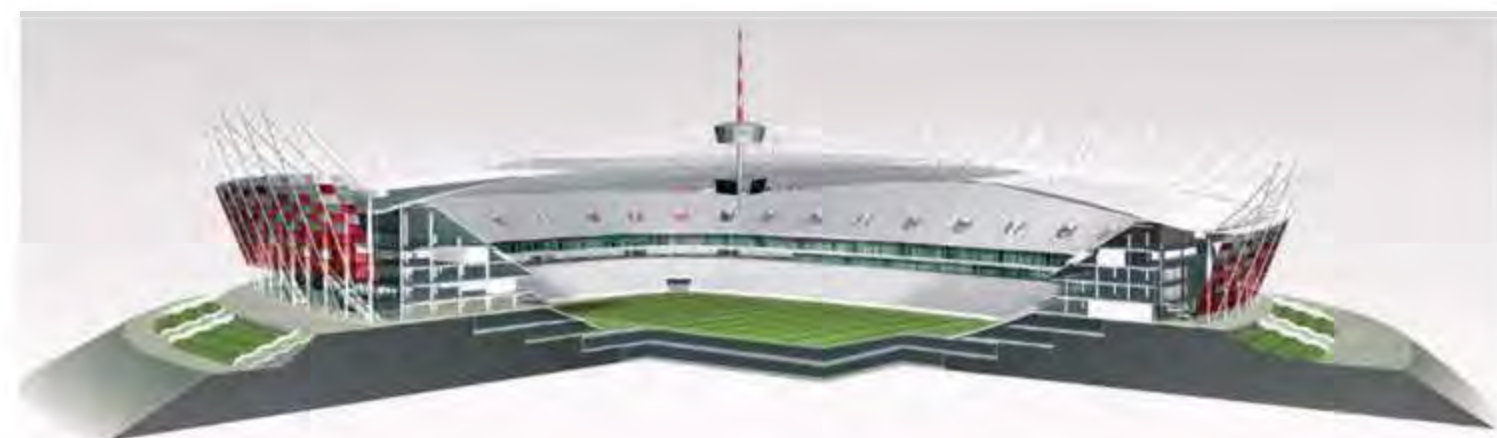


Ground floor/Entrance level



Second basement level/Playing field



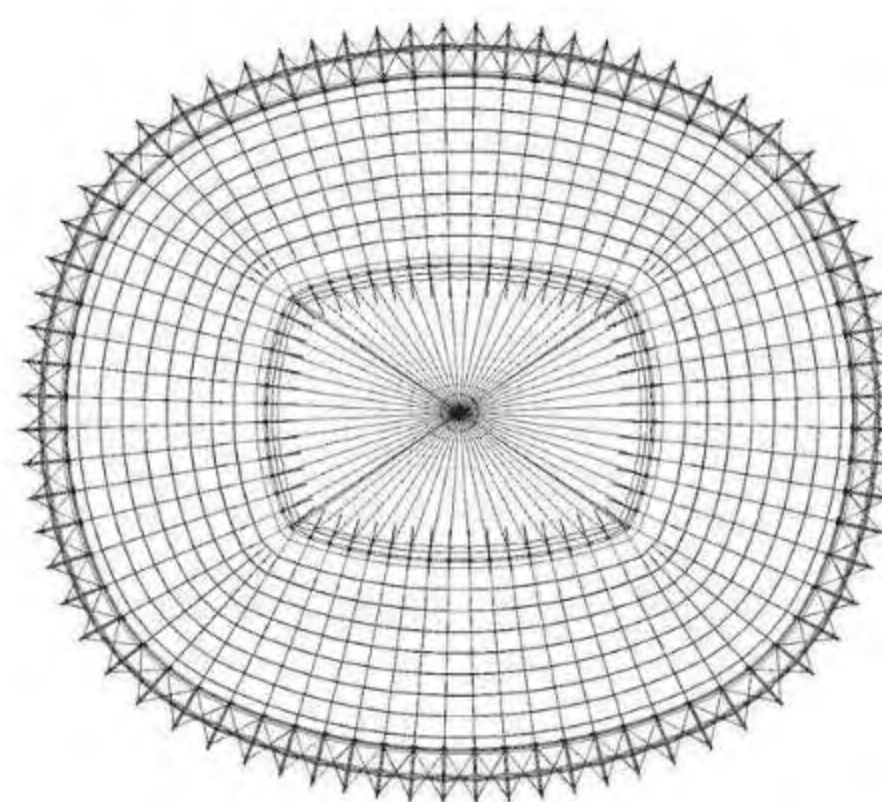
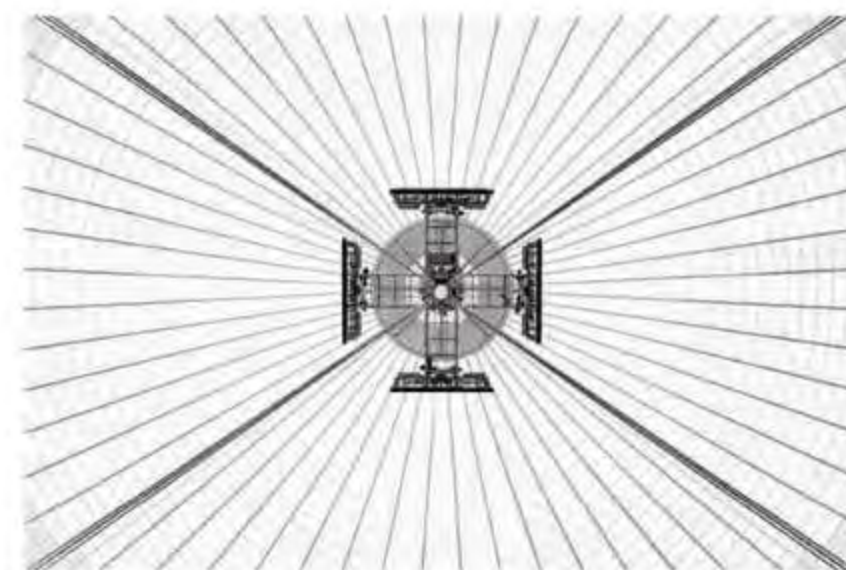


Load-bearing structure

The stadium roof structure is based on the principle of a spoked wheel in a modified form. A compression ring (the rim), which is here oval on plan, is raised on vertical columns to the level of the grandstand roof and forms the outer edge. A further ring, consisting of a sheaf of tension cables, is situated above the playing field, the layout of which it

follows, namely a rectangle with rounded corners. The fixed covering over the stands ends at this line. At the centre of the structure is a 70-metre-high needle with a "garage" that houses the mobile section of the roof. The needle is held in position by four lower and 60 upper radial cables ("spokes"), that terminate in a cluster ring. For the fixed

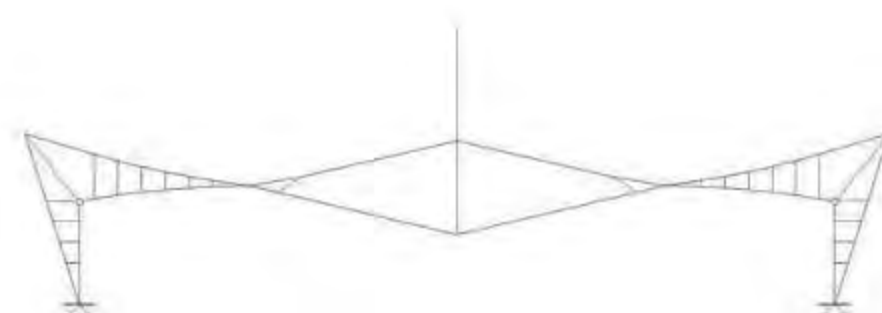
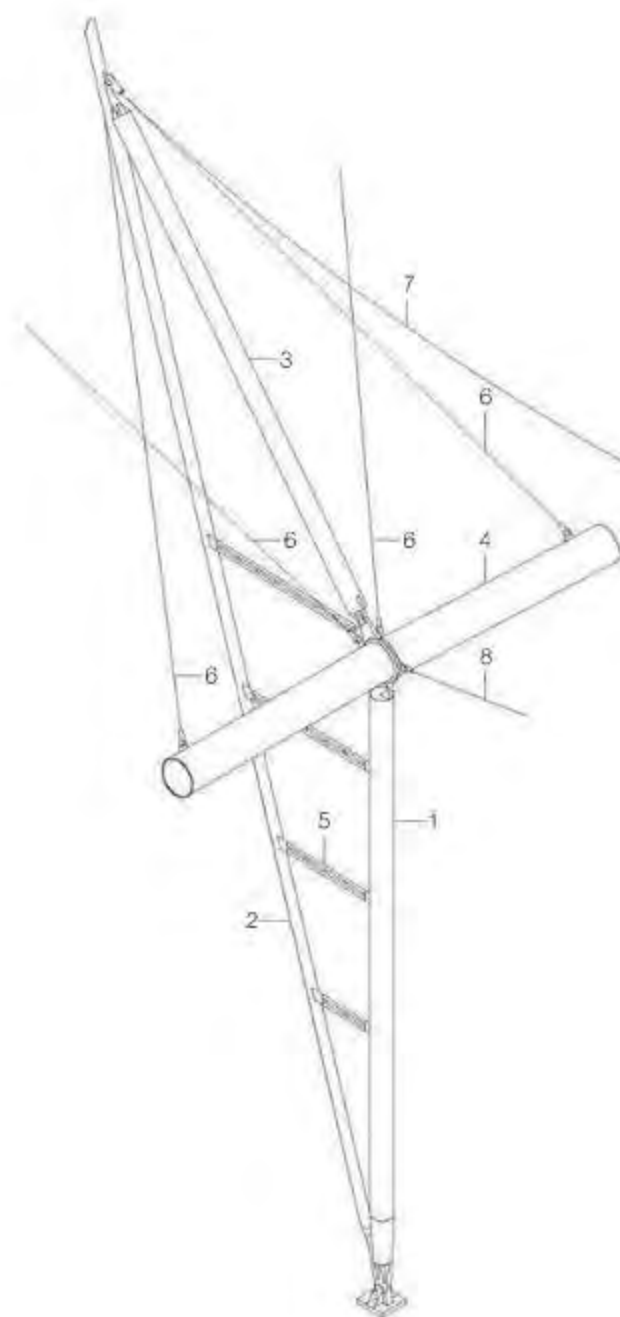
section of the roof over the stands, 72 upper and lower radial cables were used. The lower ones terminate in a compression ring; the forces of the upper radial cables are drawn over a raking compression bar and over the facade tension bar before being conducted down to the ground. Also fixed to this tension bar are the metal facade panels.

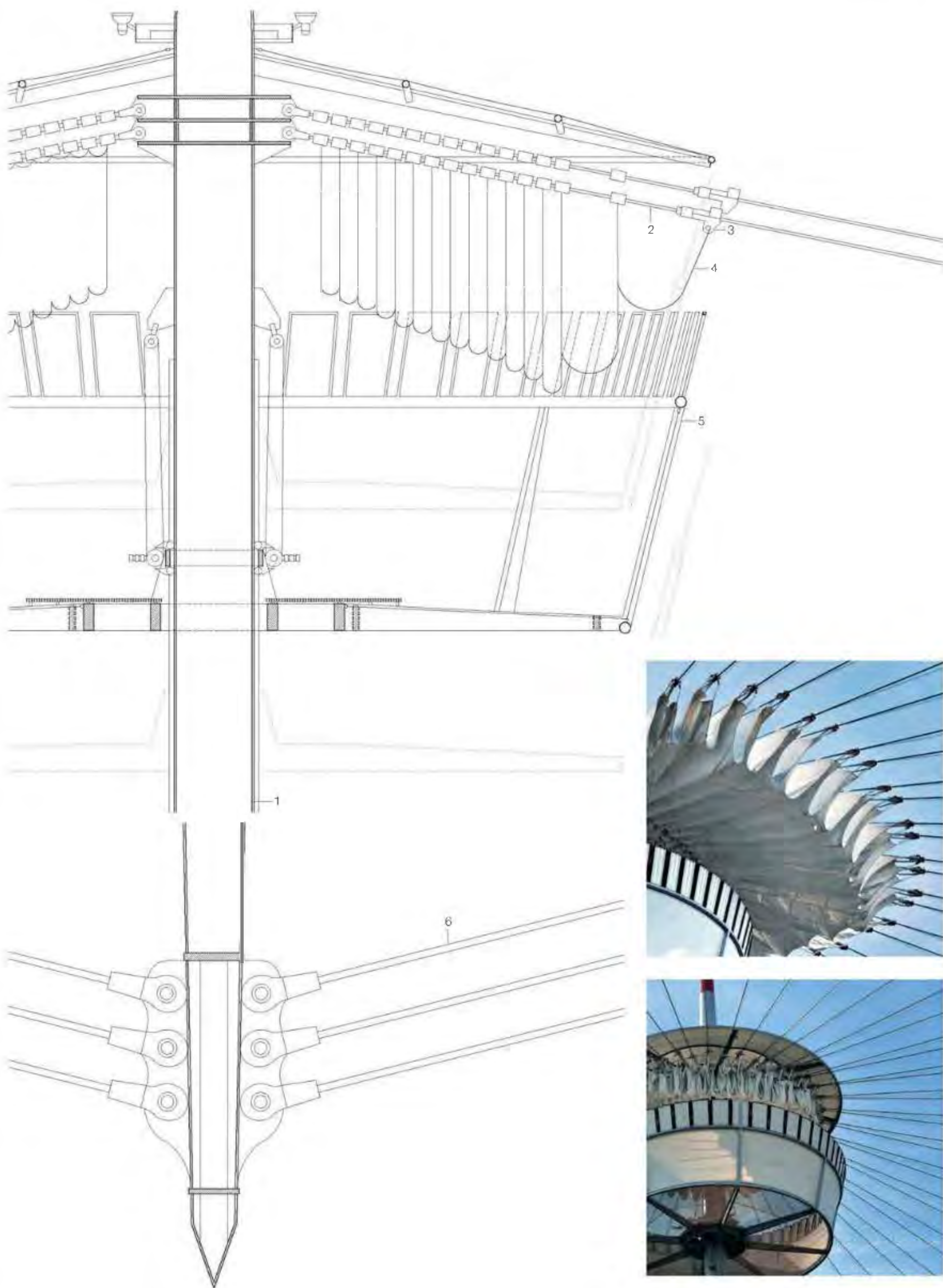


Structural system
scale 1:3000

- 1 Column
- 2 Facade tie
- 3 Strut

- 4 Compression ring
- 5 Facade strut
- 6 Compression ring anchor
- 7 Upper radial cable
- 8 Lower radial cable

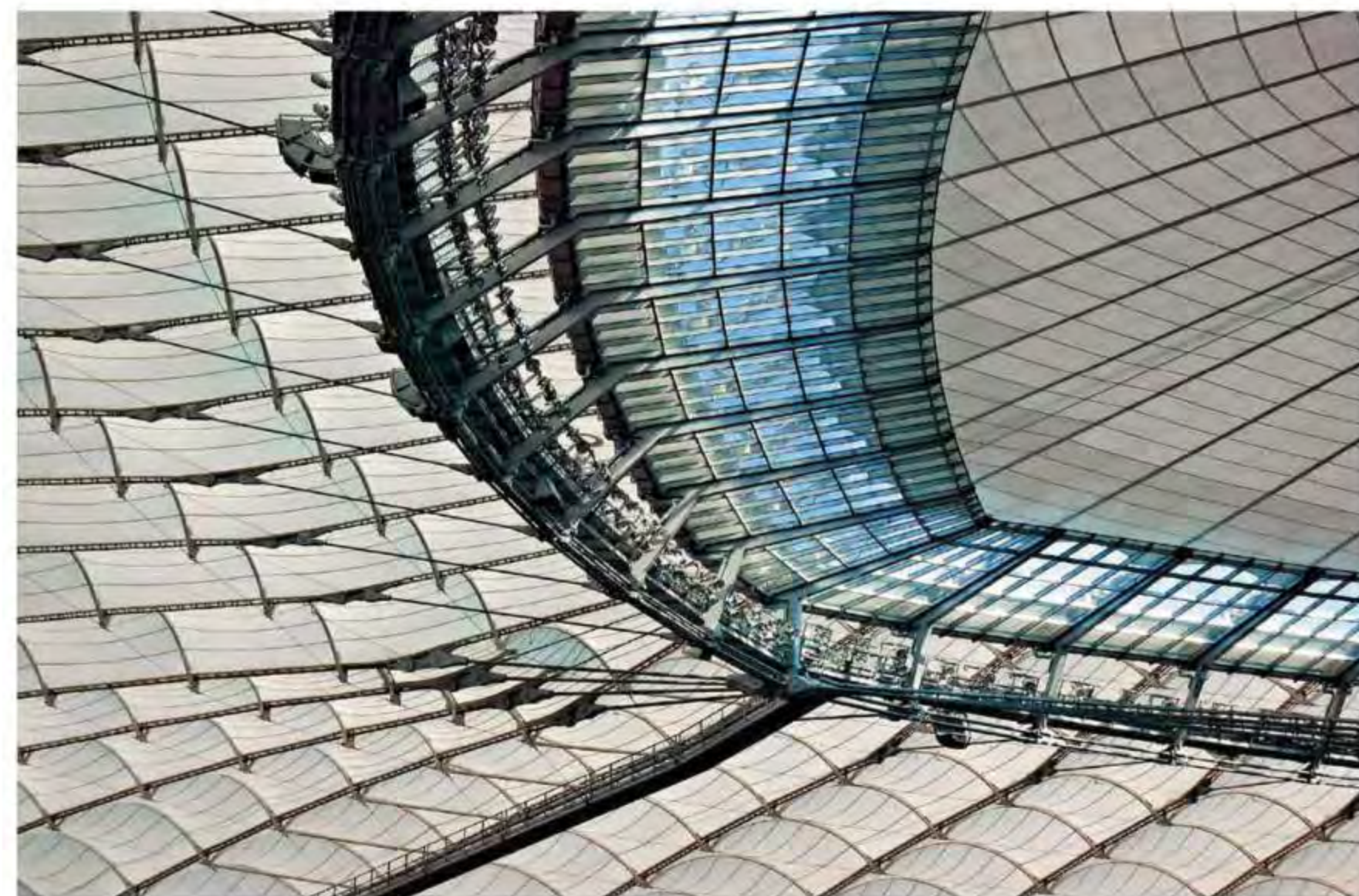
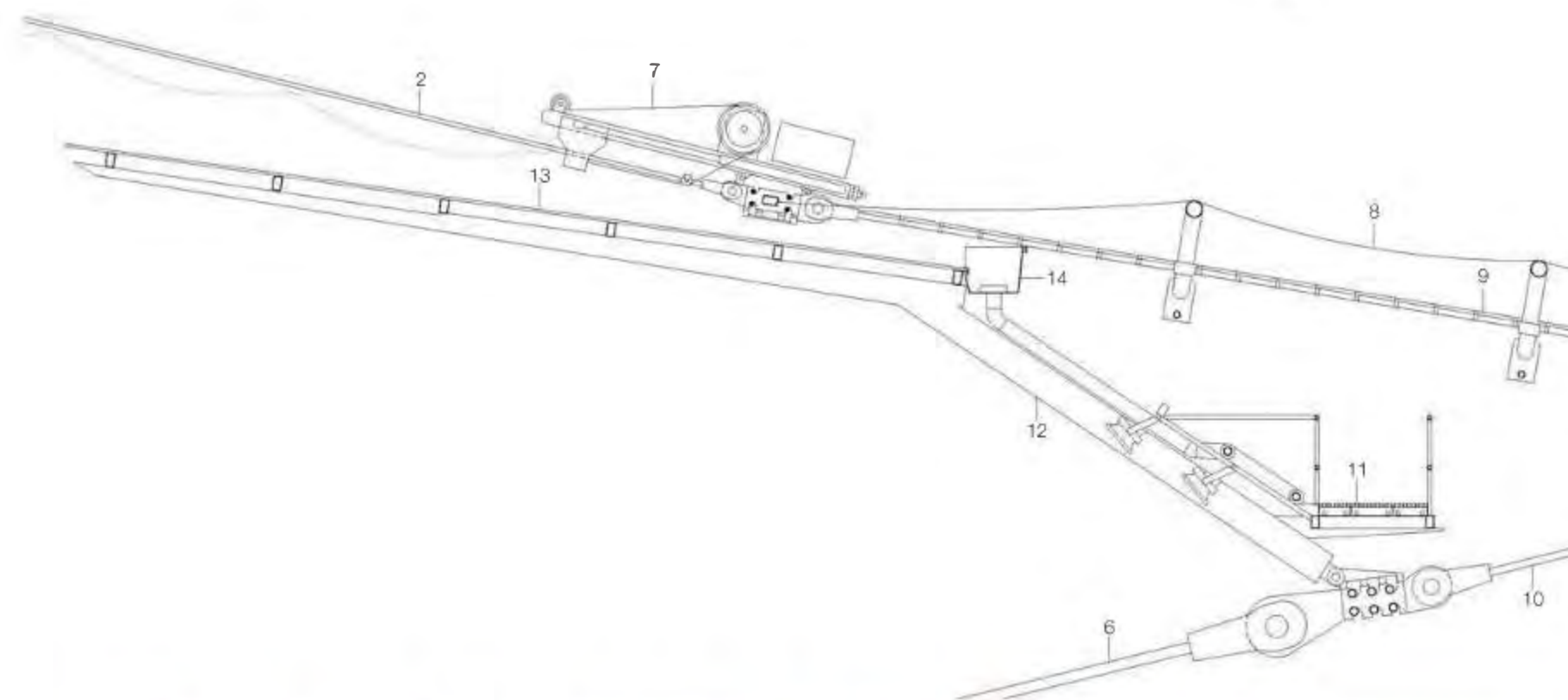


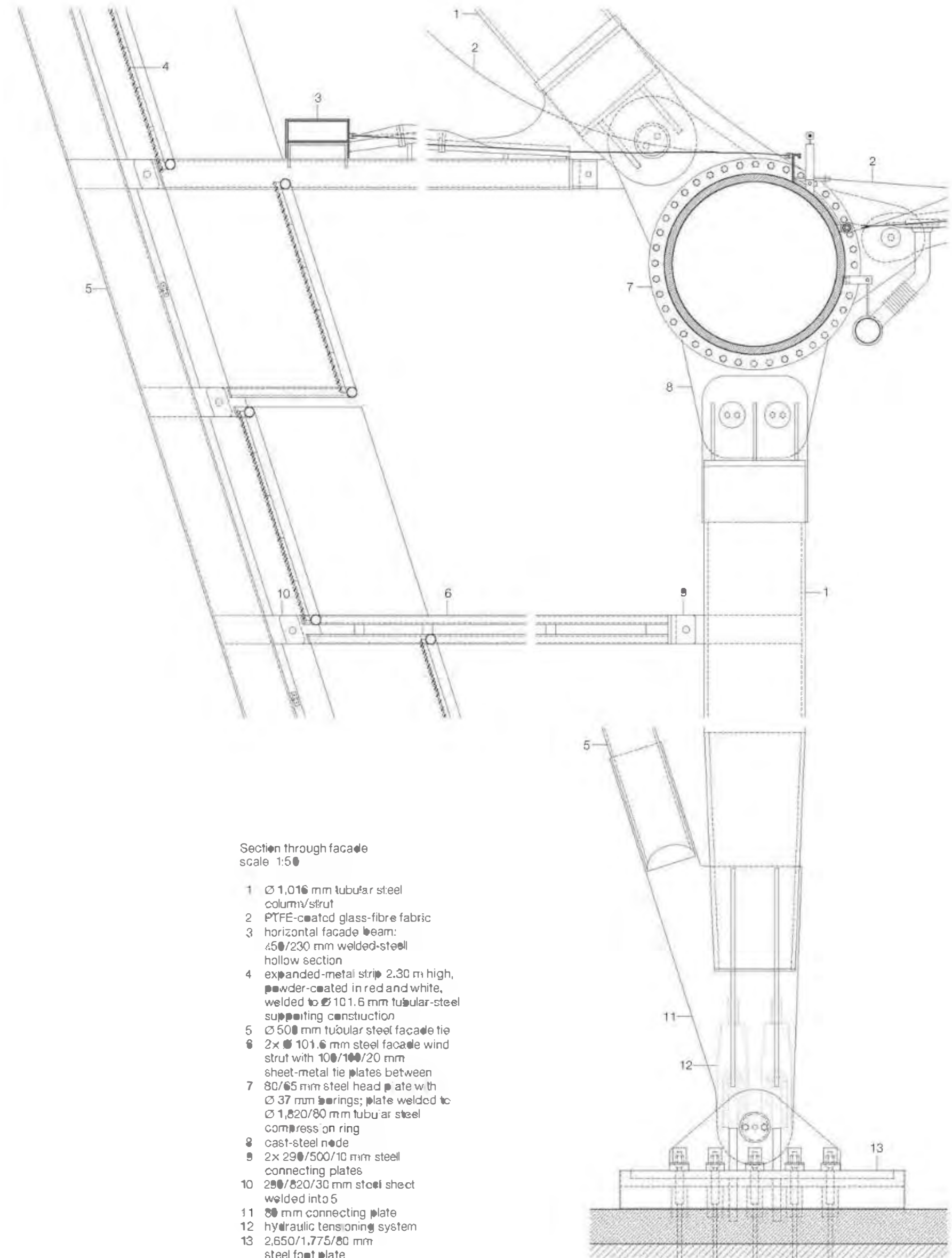
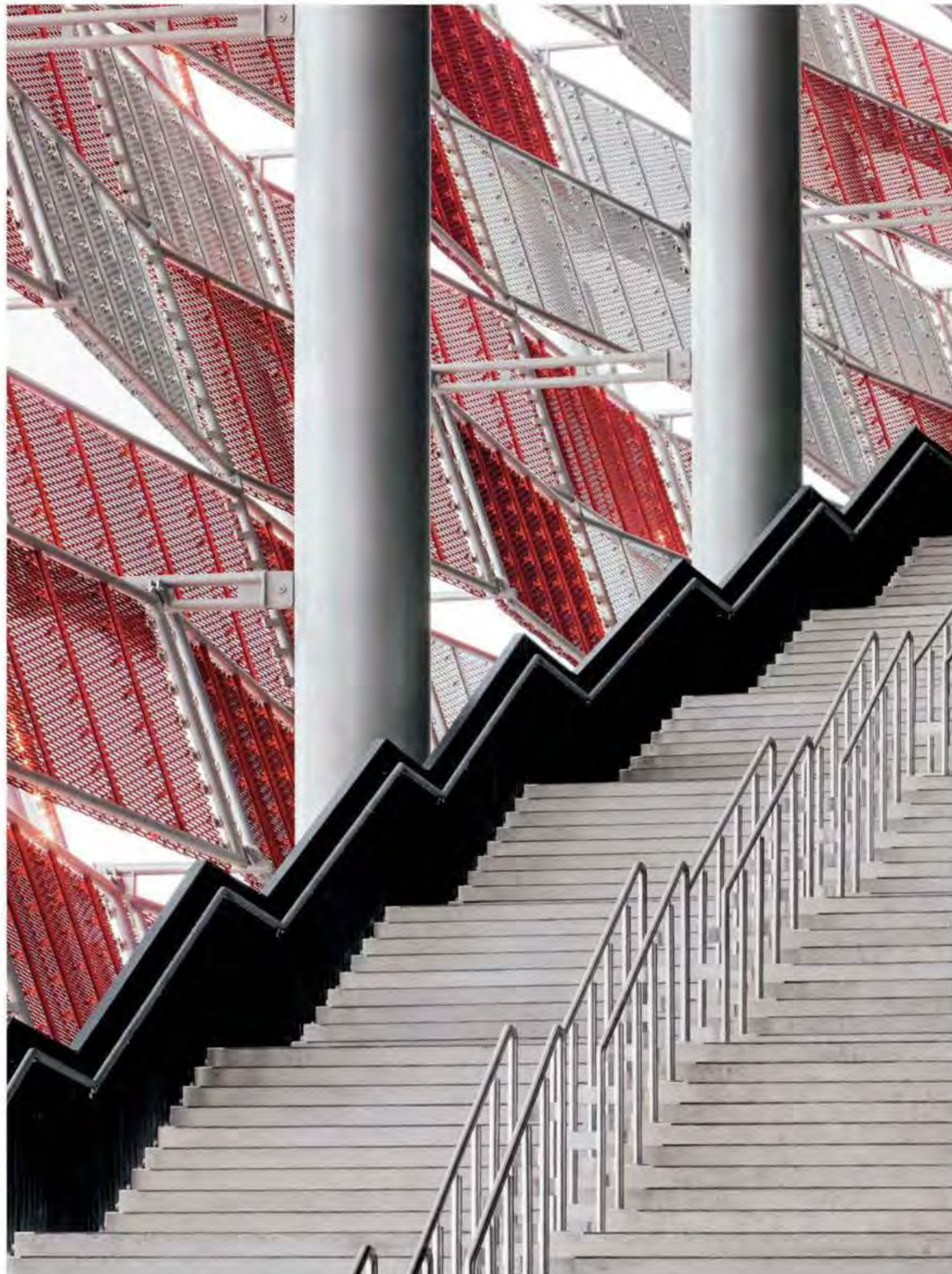


Section
scale 1:100

- 1 $\varnothing 1,000-1,600$ mm central column (needle) 70 m long
- 2 $\varnothing 70$ mm upper radial cable
- 3 sliding carriage operated by electric cable winch with membrane straps fixed to 4
- 4 movable textile roof: PVC-coated polyester fabric
- 5 hydraulically lowerable membrane garage

- 6 $\varnothing 14.5$ mm lower radial cable
- 7 hydraulic tensioning unit
- 8 fixed textile roof: PTFE-coated glass-fibre fabric
- 9 $\varnothing 70$ mm lower radial cable
- 10 $\varnothing 70$ mm anchor cable
- 11 maintenance walkway
- 12 "flying mast", angle according to axis
- 13 18 mm laminated safety glass on steel supporting structure
- 14 drainage for glass roof

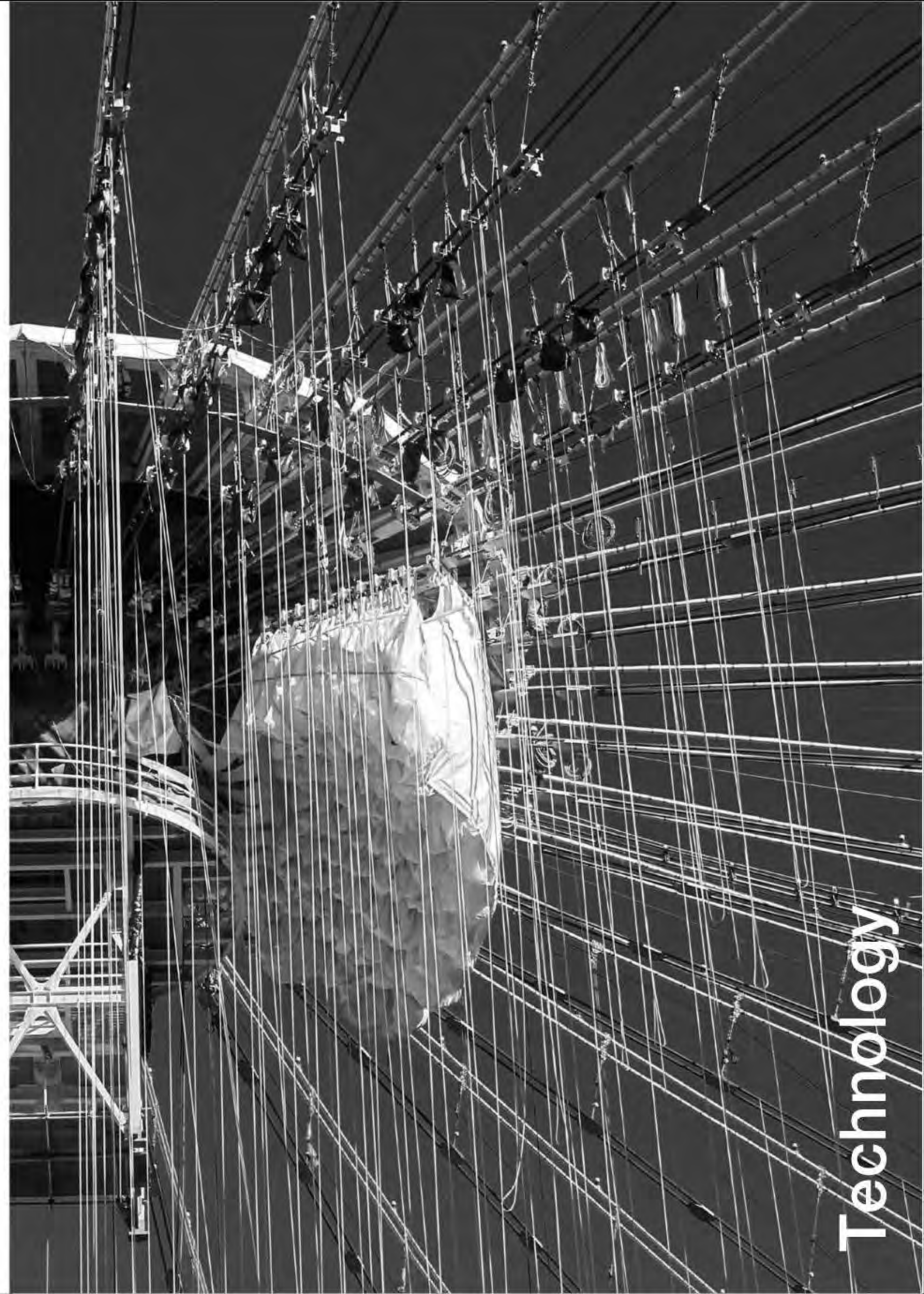
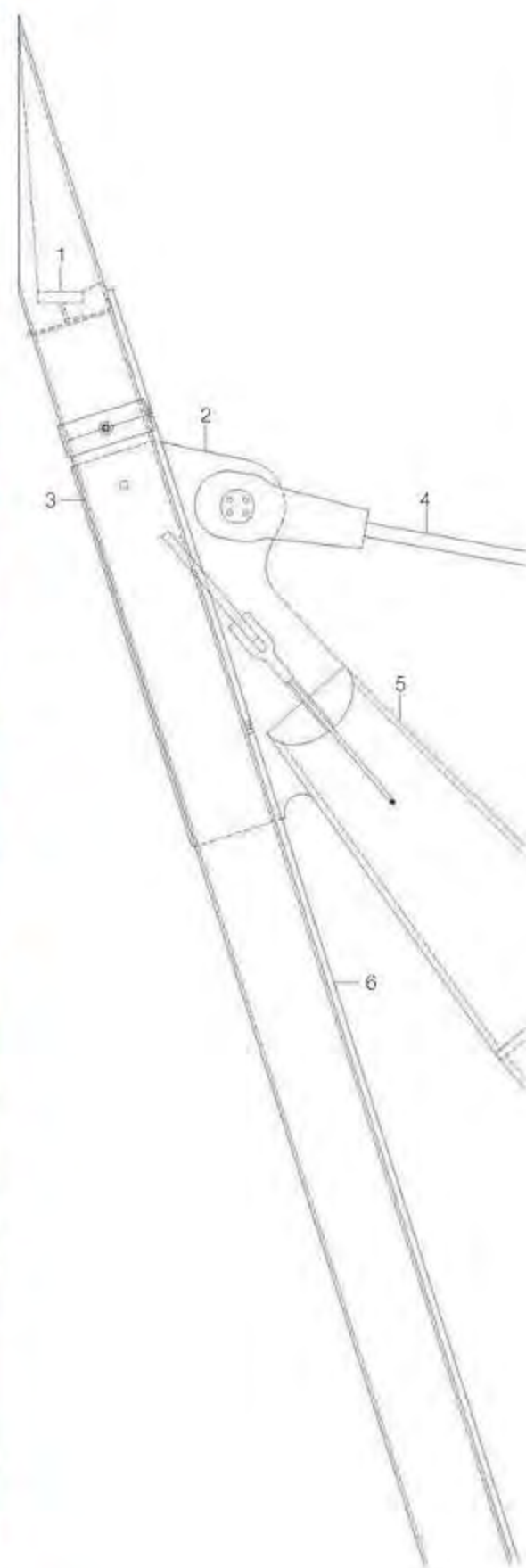






Section
scale 1:50

- 1 LED fitting
- 2 80 mm connecting plate welded into 3
- 3 Ø 508 mm tubular steel facade tie
- 4 Ø 80 mm steel cable stay
- 5 Ø 1,016 mm tubular steel strut
- 6 electrical duct



Modern Adjustable Membrane Roofs in Warsaw and Vancouver

Jan Cremers, Gregor Grunwald



Membranes are of ever increasing importance in the construction of stadiums today. Flexible materials of this kind are used for such roofs in probably the majority of cases – for new structures as well as for conversions and refurbishments. In some projects, they are specified not just for the roofs, but for the facades as well. In addition to the protection they provide against the weather, the internal daylight conditions they allow are of growing significance. This helps to stimulate the growth of grass and to reduce the potential for aggression, but above all it allows high-quality television images – with an absence of columns and an even lighting quality with limited contrasts.



One of the principal advantages of flexible membranes is their translucence, usually with a high degree of light diffusion. The typical geometry of stadiums and the requisite absence of columns result in large spans. For this purpose, planar bearing structures subject to tensile loading have been developed in recent decades. These offer economical solutions through the use of very light and translucent membrane materials. The light appearance of early solutions was mostly bought at a high price, however: the structures were rear-anchored with massive foundations. Today, "spoked-wheel systems" are largely used, commonly based on the model of the membrane roof in Stuttgart (1993), which was developed by the engineers schlaich bergemann und partner (sbp). In the meantime, membranes have been subject to an aesthetic change. Instead of having large, continuous areas, the structures are segmented by the radial cables that are used, with a corresponding stabilization of individual sections and the repetition of smaller units; e.g. through the use of arches between the radial cables (see interview with Volkwin Marg, page 570). One special subgroup of the spoked-wheel form is that in which, in addition to a fixed roof in the outer areas, there is a separate structure at the centre that can be drawn together as a further covering. This allows events to be programmed throughout the year independently of the weather, while the translucent material nevertheless ensures daylight conditions even in a closed state. Important forerunners of larger-scale flexible membrane structures of this kind and to this scale are the stadium in Saragossa (1989) and the Commerzbank Arena (Waldstadion) in Frankfurt (2005), the engineers of which were also schlaich bergemann und partner. For decades now, the Hightex company has been active in this field. Examples of its work include fixed roofs for arenas in Stuttgart, Busan, Abuja, Berlin, Robina, Johannesburg, Cape Town and Kiev as well as movable (sliding/folding) roofs in



1 Rothenbaum, Hamburg, and in Wimbledon and Warsaw.

Warsaw National Stadium

Following the competition in 2007 for a new National Stadium in Warsaw, a roof structure was built according to the spoked-wheel principle. The closable inner section allows the stadium to be used all year round – not just for football – and regardless of weather conditions (ills. 1–5; see also page 620). Cable trusses laid out in radial fashion are fixed between the central hub, a cable ring over the edge of the playing field, and a peripheral outer compression ring. The radial cables extend from the upper end of the raking support, or from the compression ring, towards the centre of the stadium, intersecting each other in cast nodes (ill. 5) and linking up with two elevated ring cables. The outer roof area, stretching over the entire grandstand to a line above the edge of the playing field, is the section of the cable structure that provides permanent covering. Inserted in the segment bays between pairs of lower radial cables are nine steel arcs (ill. 5). These act as stabilizers in part areas, and they form the edge geometry of the roof membrane, which in this section consists of PTFE-coated glass-fibre fabric with an overall area of approximately 55,000 m². Prefabricated at works, the individual membrane sections were hoisted into position on the structure, unfolded and fixed over the arcs to the compression ring, as well as to the radial and ring cables, where they were subject to tensioning.

The variable roof in the middle

The oval inner area of the stadium above the playing field can be covered by a second structure. A 70-metre-long "flying" central column or mast is suspended by four cables from the lower radial cable. The column is held in its middle by 60 axial cables that extend upwards. Fixed to the lower part of this mast is a travelling "membrane garage" (ill. 4). After lowering this unit, the roof membrane within can be unfolded outwards



- 1–5 National Stadium, Warsaw; architects: gmp, JSK Architects; structural planning: schlaich bergemann und partner (sbp); general planners: Alpine Bau Deutschland, Hydrobudowa Polska; cable construction: Omelal, Hightex; membrane construction: Hightex
- 1 A quarter of the 10,500 m² membrane comprising the movable inner roof prior to the heat-sealing of the four sections on the cable structure
- 2 One of a total of 60 hydraulic tensioning devices at the junction between the movable and fixed sections of the roof; 12 mm laminated-safety-glass roof (2x 8 mm)
- 3 Carriages on radial cables with electric cable winch
- 4 The inner roof with 60 radial cables
- 5 Sealing the PTFE-coated glass-fibre membrane of the fixed section of the roof at the cast nodes of the cable construction

along the 60 radial cables by means of 15 fixing points that glide linearly. These "gliding trolleys", as they are called, are attached to the membrane by means of radial straps. The carriages fixed to the edge of the membrane are drawn outwards by electrically operated cable winches, and the gliding trolleys are pulled behind (ill. 3). By virtue of different drawing speeds along the individual axes, the carriages engage simultaneously with the hydraulically driven, self-locking tensioning construction. This guarantees the power-operated final tensioning of the membrane when it is unfolded. Drawn into its ultimate position, it is pretensioned axis by axis, so that it can

bear the requisite loads and protect the stadium from the effects of the weather. The entire process takes about half an hour. The joint between the fixed and movable sections of the roof is closed by a 10-metre-wide glass covering fixed to the radial cables. This glazed construction is situated immediately below the membranes and is drained by virtue of the fact that it slopes towards the outside (ill. 2). The membrane of the sliding section of the roof consists of a PVC-coated polyester fabric, a translucent material that is capable of repeated movement, folding and unfolding. In the outer areas where the loads are greatest, so-called "type 4 material" was used. In

Bibliography:
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the central area, a somewhat lighter "type 3 material" was sufficient. On close examination, a slightly different degree of translucence can be determined between these two materials. The sliding roof was prefabricated in four parts at works (ill. 1), delivered to site and joined together in position on the roof to form a larger area roughly 10,500 m² in extent. For this purpose, a stationary welding machine was used, hung temporarily from the cable structure. The straps consist of polyester and have a tensile strength of up to 40 tonnes. A close investigation of their long-term stretch and creep behaviour was necessary





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to determine the requisite stress path of the travelling roof.

BC Place stadium, Vancouver

In the BC Place stadium in Vancouver, a travelling roof also ensures that the operation of the facilities remains flexible and independent of weather conditions. Erected in the early 1980s, the Airdomes arena could accommodate 60,000 spectators. Its pneumatic roof, stabilized by increased internal air pressure, is now being replaced by a new form of roof construction based on the principle of a prestressed spoked wheel. The new image of the stadium is dominated by 36 peripheral columns that

rise high above the structure and which accentuate this location for various events in the imposing skyline of Vancouver (ill. 9). The tiers of seats are covered by a single-layer membrane consisting of PTFE-coated glass-fibre fabric. The centre of the roof can be opened and closed by means of a two-layer pneumatic cushion structure that is unique in its nature and size. In an unfolded state, it can be inflated with compressed air to create a cushion that is stable in form. In this position, the mobile roof of coated PTFE fabric is designed to withstand snow and wind loads, and the two-layer cushion construction provides a certain thermal protection. In contrast to the

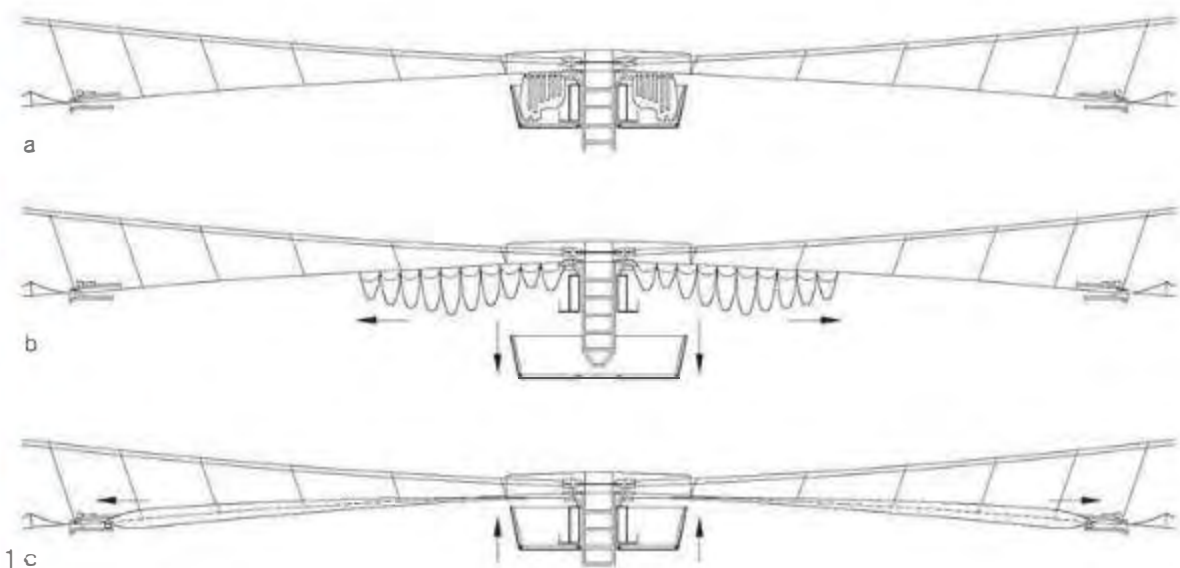
sliding roof in Warsaw, the Canadian structure is in its normal position when closed. The mobile roof, with an oval layout, has dimensions of roughly 80 x 100 m in an extended state. Divided between 36 axes, the individual cushion bays are arranged in radial fashion about a central mast approximately 60 m above the playing field. The mast bears the load of the "garage" or parking space for the roof, into which the membrane can be folded (ill. 12). In order to open the roof, the blower units installed round the central mast actively suck compressed air out of supply tubes in the cushions (ill. 10). Finally, the deflated membrane is drawn by motor via its sliding



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mountings along the suspension cables. The membrane folds together into the middle and is protected by the upward travelling garage. When the roof closes, the membrane is drawn outwards on to the glass apron roof installed beneath the ring cable. Through the subsequent inflation of the cushion, the roof structure is stabilized. A radial sealing torus forms the outer closure of the movable membrane. With increasing air pressure, this closing element presses firmly on to the glazed roof, thereby creating the necessary seal for the structure (ill. 8). The process of opening or closing the more than 7,500 m² movable "blue sky roof", as it is known, takes just 20 minutes. It allows an all-year use of the stadium regardless of weather conditions. As a travelling cushion construction, it is unique in this form and with these dimensions.

Summary

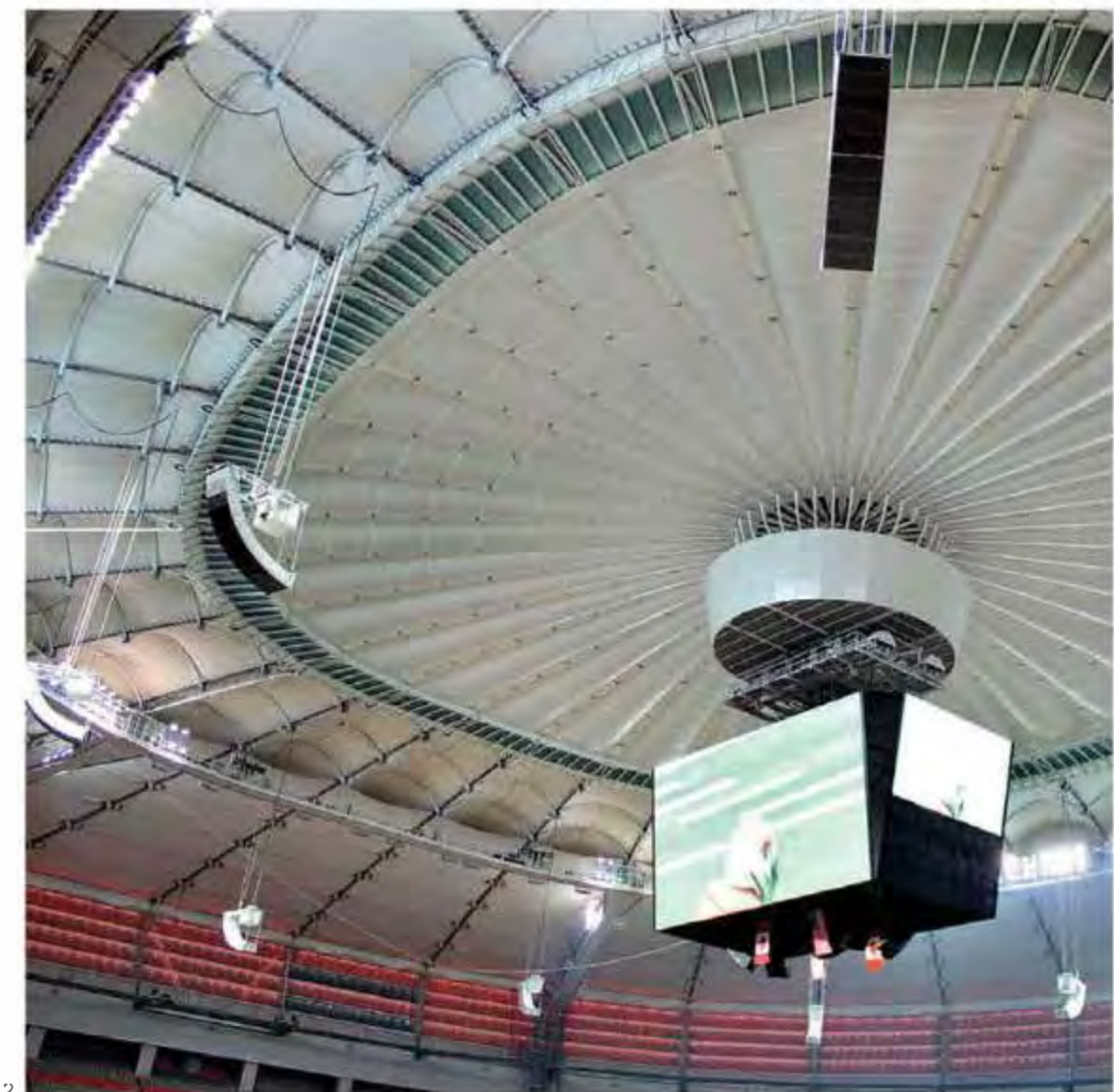
In recent decades, flexible textile and membrane substances have firmly established themselves as a complement to "classical" building materials. Their use still offers designers considerable scope for differentiation, and their development is by no means complete.

Membranes can be seen both as a reference to the archetypal history of architecture and to efficient high-tech future-oriented materials. Permanent use in different climatic and cultural realms is possible, on the one hand because of the basic properties of certain materials, but also in view of the adaptable forms of construction. Membranes have a wide range of properties as well, not least of which is their light transmission. Furthermore, flexible materials – alongside rigid structures – allow movable, changeable forms of construction on a large scale. Other advantages accrue as a result of the very small masses that are involved: for example, membrane materials weigh between 0.4 and 2 kg per m². In comparison with alternative forms of construction, the weight per unit area is far lower as a rule, which can result in a reduced use of materials in the primary and second-

ary construction as well as in a smaller outlay for transport, assembly and the ultimate removal (ills. 6, 7). The overall energy balance for the entire life cycle is, therefore, advantageous in comparison with more solid forms of construction. In principle, membrane structures, which are nearly always prototypes, show what a superior performance level can be achieved through a collaboration between highly qualified planning teams and the companies executing the work – an essential condition for innovation. This applies in particular to the transformable structures presented here in two outstanding examples.

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Dr.-Ing. Gregor Grunwald is project manager at Hightex.

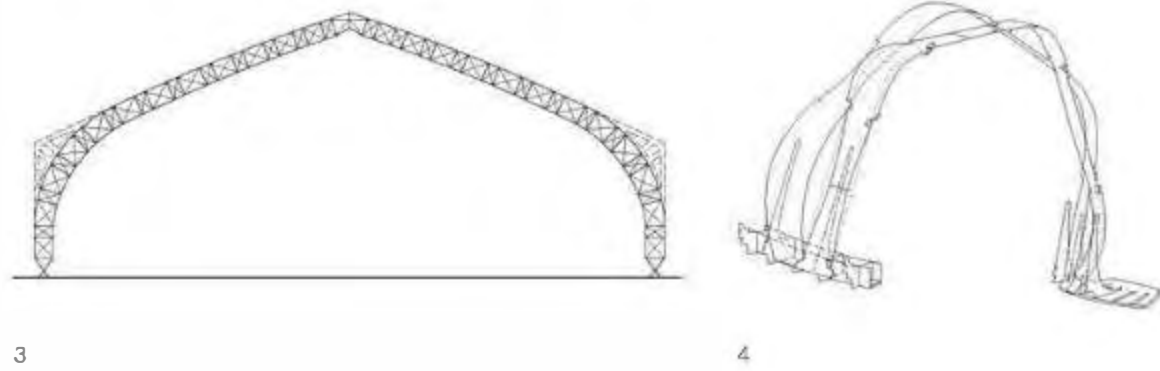
- 6–12 BC Place, Vancouver
architects: Stantec Architects
structural planning: schleich bergemann und partner, Gelger Engineers
general planner: PCL Constructors
membrane construction: Hightex
The inner roof consists of coated PTFE fabric
Inner-roof cushions with pressurizing mechanism
10 Assembly of compression tubes within cushion
11 Stages of closing the inner roof:
a in open state;
b lowering the "garage",
extending the membrane
c inflating the cushions



12

From the Construction of a Building to the Design of the Processes Involved

Jan Knippers



1, 3 Galerie des Machines, 1889;
architect: Charles Louis Fournier and Dutert
engineer: Victor Contamin
2, 4, 5 ICD/ITKE research pavilion, 2010;
architects and engineers:

ICD project team (Prof. A. Menges) and
ITKE (Prof. J. Knippers)
6 Sea urchin as a natural model for shell structures
7, 8 ICD/ITKE research pavilion, 2010;
6.5 mm birch plywood

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Paradigms of traditional structural planning

For every task with which it is confronted, architecture knows an almost endless range of solutions. Exploring these and reducing them step by step is probably what one understands by architectural design. The goals and criteria that determine this process have to undergo repeated redefinition; they are subject to constant change, and for the most part, they are anything but quantifiable. In contrast to architects, engineers can draw on only a limited range of possibilities. Towards the end of the 19th century, the theory of structures was introduced as a tool for design and analysis. Since then, a reliable calculation of forces, strains and de-

formation has been regarded as essential for all building construction. The theory of structures and constructional principles follow just a few rules, the reliability of which has first to be proved. For that reason, rules of this kind are developed in a series of successive stages, which results in fixed constructional and structural typologies that are subject to constant reuse.

Towards the end of the 19th century, for example, structural design introduced hinged joints to arch and frame construction – not to increase the efficiency of these forms, but to make them calculable. Similarly, the support reactions and inner forces of a three-pin arch can be calculated reliably with simple laws of equilibrium. Fewer than three hinges make the calculation more complex and less reliable. More than three hinges result in an unstable system. For that reason, with few exceptions, the many large hall structures created towards the end of the 19th century were based on the typology of the three-pin arch (ills. 1, 3).

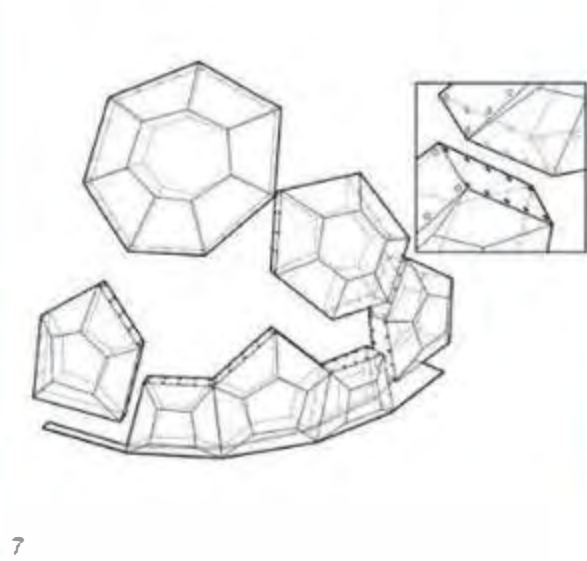
New structural forms through parametric planning

The temporary ICD/ITKE research pavilion erected in 2010 comprises a seven-hinged arch. According to the above theory, therefore, it is based on an unstable system (ills. 2, 4, 5). The structure becomes viable by varying the arrangement of the hinges and thus distributing the weak points in the arch over the surface of the shell. In this case, the geometric variation of the building components, made possible by a computer-aided manufacturing process, is a condition here for the stability of the construction. The plywood strips used for the research pavilion have a thickness of only 6.5 mm. In other words, they are so thin that they can scarcely bear their own weight over a length of more than two metres. A total of 40 pairs of arches, consisting of 10-metre-long plywood segments, were lined up and joined together. Only through a process of curving the strips and subsequently linking them to adjoining members could a structure be created capable of bearing loads. The pavil-

ion thus diverges from all common load-bearing structures, which are optimized in order to keep the curvature to a minimum. For this new class of construction, the concept of the "bending-active structure" is used (to borrow the terminology of Heino Engels). The inner tensions that occur with these large deformations and the resultant geometry can be simulated nowadays with methods that have been available in general engineering practice for only a short time. The scope offered by parametric modelling and digital production has been the subject of intense discussion for nearly 20 years. What is involved in almost all cases, though, is the planning and implementation of complex geometries. The pavilion in Stuttgart shows that computer-aided processes can also facilitate the creation of new structural forms that do not belong to common constructional typologies.

From construction to the design of the processes

A central challenge with digital processes is organizing and controlling the flow of data. This calls for a much greater involvement in the planning process on the part of engineers, instead of the repeated application of certain methods to achieve similar goals. Rarely is it taken into account that present developments call for a fundamental redefinition of the engineer's work – away from the construction of a building and its elements towards the shaping of the process, the interfaces involved and the requisite tools. When the first lattice-shell domes were erected, a key aspect was the rationalization of the geometry and construction. All geometric and structural situations in a building were to be met as far as possible using identical components. Today, however, considerations of this kind are only secondary. Complexly shaped strip-like shells are put together from a virtually endless number of metal sheets and linear elements with all kinds of geometry. Production, administration and an interchange of the requisite data are coming to play a central role in building practice. One finds, however, that



adequate computer programs are scarcely available for this at present. Not only the interfaces have to be redefined and reorganized; even for the relatively simple task of generating the network, solutions have to be developed for each specific project, and these must be adapted to the respective structural and geometric requirements of the scheme.

Individual solutions for the generation of networks

For the roof of the Westfield Shopping Centre in London by Benoy International Architects, a planar network was projected on to the wave-like geometry of the roof. In con-

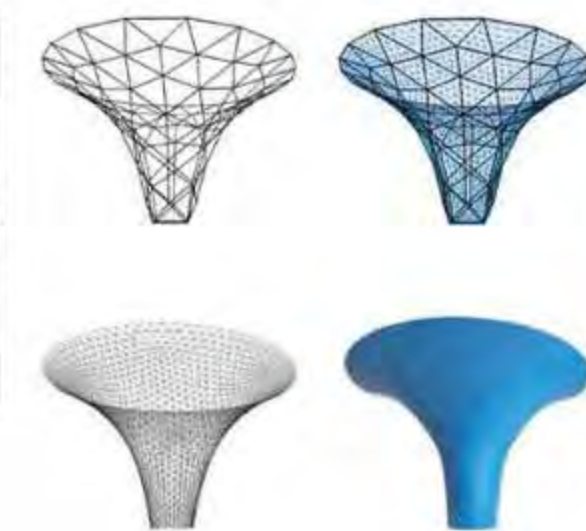
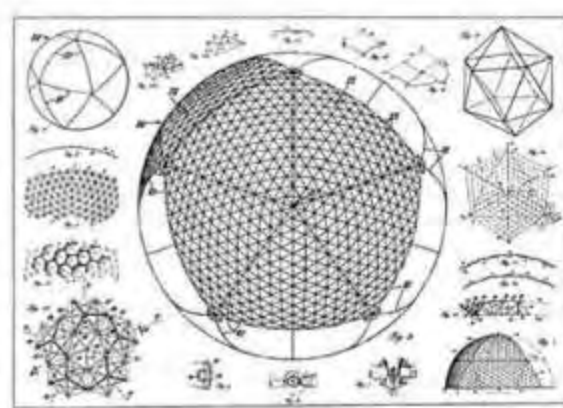
trast, for the huge membrane roof created for the Expo 2010 in Shanghai by Knippers Helbig Advanced Engineering, it was possible to revert to earlier considerations of Richard Buckminster Fuller (ill. 9). First of all, the surface is more or less manually covered with large triangles, which are then divided into a network of regular triangles of smaller dimensions (ill. 10). At the points of intersection of the large triangles, special nodes occur that are unavoidable with a non-developable surface where junctions of five to seven staves are formed, in part. Buckminster Fuller applied this principle in the 1960s to his geodesic domes to minimize the number of different nodes and

staves. In Shanghai, on the other hand, the principle served as the starting point for a computer-based optimization process in which the difference between adjoining node angles and staff lengths can be balanced out, and the network is condensed at the points of greatest strain. In this particular case, that occurs especially at those points where the edge cables of the membrane pull with very great forces on the shell. The result is a homogeneous, regular network in which the elements are arranged in accordance with the stresses: at the base, with a vertical alignment of the staves, reflecting the fixing of the funnel at the foot; at the top, with a circular orientation to brace the edge and with additional local points of intensity where loads are introduced from the membrane (ill. 11). The network generated in this way serves as a basis for the structural calculation and the manufacture of the building components. The cross-sections of the linear elements and the thicknesses of the metal sheeting determined in the structural calculations are fed into the workshop planning. This has to be checked structurally once more, however, in terms of connection details, such as junction plates, the diameters of bolts and screws, and the thicknesses of welded seams. After revising the workshop planning, the actual production takes place. In other words, an interrelated process is set in motion, involving form-giving, network development, structural calculations, construction and execution. This does not have very much in common with the traditional linear planning sequence, in which the architect initially determines the form, then the engineer the structure, and finally a construction company is engaged to execute the work.

Supervision of the 3D model

In this respect, new tasks arise, such as the organization and supervision of a 3D model, or the programming of software tools to generate the network and to transfer data. Hitherto, these did not form part of the list of services provided by architects and engineers, and they are therefore not to be found in





- 9 Patent: Buckminster Fuller, 1951
 10, 11 Expo Axis, Shanghai, 2010;
 architects: SAA Architects;
 structural planners: Knippers Helbig
 Advanced Engineering
 12–15 Shenzhen Bao'an International Airport,
 Terminal 3, 2013;
 design architects: M. and D. Fuksas;
 structural planning of roof and facade:
 Knippers Helbig Advanced Engineering
 Competition rendering, Studio Fuksas
 13 Building site, March 2012
 14 Building skin: parametric Rhino model (top)
 and physical model (bottom)
 15 Roof construction, still without internal
 cladding

their scale of fees. Who should assume responsibility for these tasks, and how the interfaces should be organized will depend on a number of factors. These include the challenges presented by the content of a project and the various competences of those involved, as well as the contractual relationships and the procedure determining the award of contracts. For the roof of the Westfield shopping mall in London, the architects had an initial formal idea, but the entire responsibility for the planning, including the structural design, then lay in the hands of the construction firm. In the case of the lattice shell for the Expo in Shanghai, on the other hand, the lattice was generated and structurally confirmed on the order of the design architect. Finally, however, it was handed over to a Chinese partner, together with responsibility for the planning. In both projects, the structural planner produced and supervised the line model for the structure, which formed the basis of the entire process from the design to completion. That

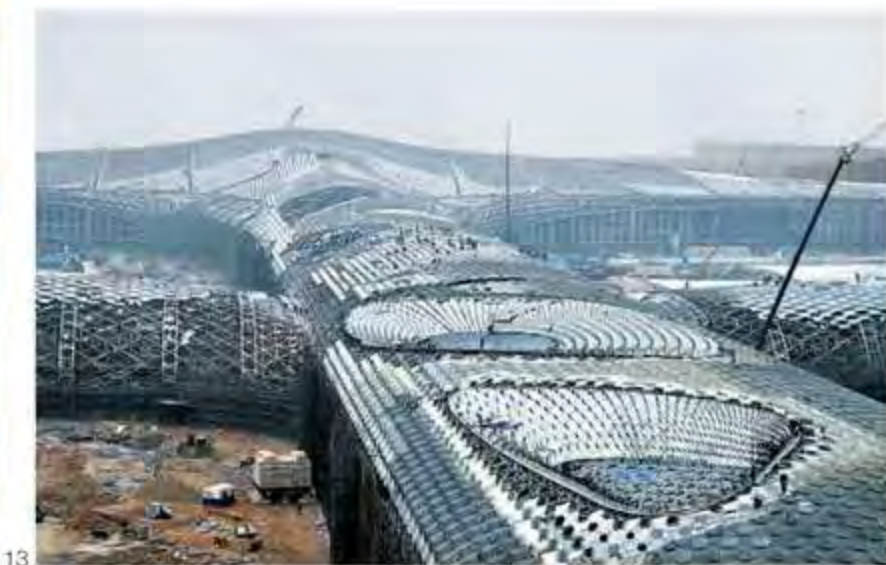
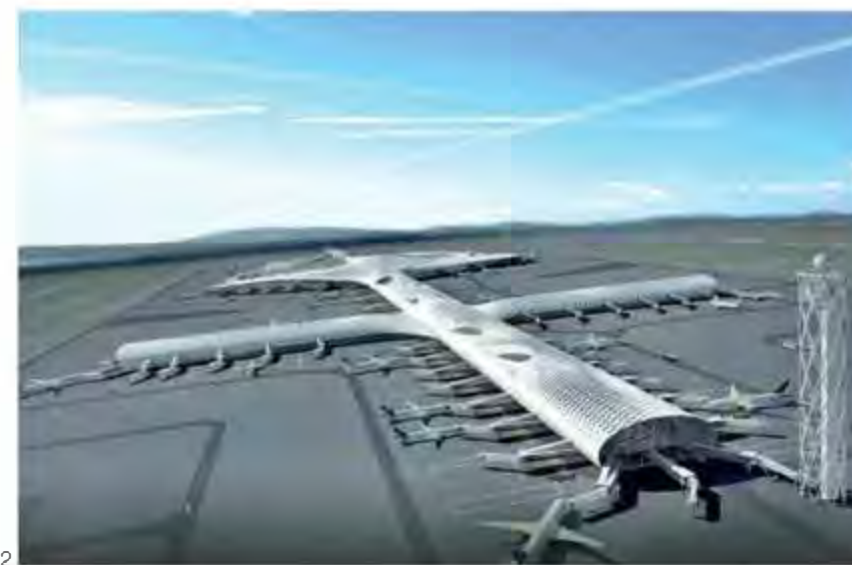
makes sense, too, since the structural engineer supports the architect in developing the form and knows his design intentions. At the same time, he is familiar with the limitations imposed by the structural calculations and execution process. As a rule, though, structural planners are not equipped to supervise the creation of complex geometries – neither through their training nor their practical work. For that reason, large architectural practices often establish their own geometry departments or call in external specialists whose work is focused on drawing up geometric data for architectural schemes, but who usually have little involvement in the design and execution.

Redefinition of the structural engineer's role
 Terminal 3 of the Shenzhen Bao'an International Airport (ills. 12–15; architecture: Massimiliano Fuksas; design and planning approval: Knippers Helbig Advanced Engineering) shows how the task of developing and supervising the geometry can necessi-

tate a redefinition of the role played by the structural planning.

The architectural concept for the roof foresees a spatial structure that is lined on both sides with a perforated, expanded-metal skin. The facade cladding forms the thermal envelope. The load-bearing structure remains visible, yet is meant to obstruct views through the polygonal openings in the two skins as little as possible. For that reason, the secondary beams are laid out on the diagonal, and the bracing arches are double. While the load-bearing concept follows simple principles, the geometry is extremely complex. The motif of expanded metal can be projected on to a developable surface, but in the case of double-curved surfaces, as occur in the terminal, this is possible only with additional modifications if the planar quality of the panes of glass is to be maintained. Originally, plans were made to match the size and angle of the openings in the almost 1,500-metre-long building to local requirements in terms of daylighting, energy input and visual links.

A parametric model was created for this purpose that took account of the axial information relating to the two skins as well as the load-bearing structure between them. The model was based on elementary software, namely Rhino 3D and Excel (ill. 14). This provided a joint platform for the exchange of information between the architects and the structural engineers in relation to the overall form and the way it is laid out with facade modules. Thanks to parameterization, it was possible to modify the architectural targets and structural data repeatedly right up to the end. After roughly 50 different versions of the terminal roof had been prepared, a simple linear arrangement of the facade modules was chosen, as they can now be seen in the finished building. The creation of this parametric model was the real challenge in the technical process; the design and calculation of the load-bearing structure followed more or less established procedures. In a project like this airport terminal, computerized tools are used as a technical aid to describe complexly



shaped structures. The potential of such tools for creating new structural forms is by no means exhausted.

New structural forms: bionics

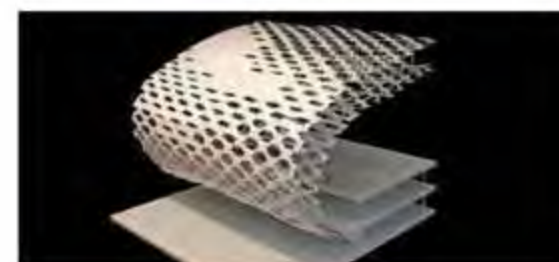
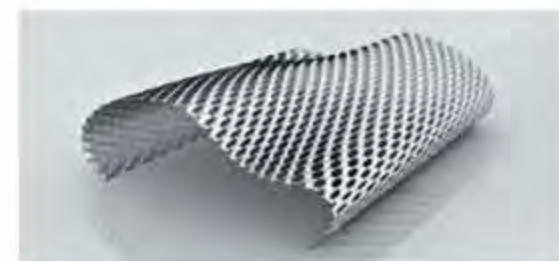
One possible means of developing new structural forms in architecture can be found in the biomorphic structures that exist in nature. Nearly 50 years ago, in an exchange with Johann-Gerhard Helmcke, Frei Otto investigated the mineral skeleton shells of radiolaria and diatoms. At that time, the aim of this research could not have been to apply the principles of natural structures directly to architecture, because no technical means existed for this. The ICD/ITKE research pavilion, 2011, was meant to demonstrate that this is now possible with the support of modern computer-aided processes (ills. 15–16; and DETAIL 1+ 2/2012). The overriding goal was the development of a constructional principle for freely shaped shell structures using prefabricated modules, since jointless shells in concrete or other materials are only

rarely economically viable. That is why almost exclusively linear framed systems are used for complex 3D geometry – structures like the examples in Shanghai, Shenzhen and London described earlier. These have to be covered with a non-load-bearing skin of glass, aluminium or other materials; but this separation of functions – spatial enclosure and load transmission – is inconsistent with the principles governing most natural structures. The exoskeleton of a sea urchin, for example, consists of polygonal plates that are able to transmit, in particular, shear and compression forces at their edges, but not bending moments. This results in a special arrangement of the modules, whereby three edges meet at a single point. With the wooden pavilion dating from 2010, one can show that this formal principle is applicable not only to forms of geometry similar to that found in the sea urchin, but also to free architectural forms with openings and changes of curvature. The size and orientation of the cells match them-

selves to the mechanical loading of the shell, resulting in the formation of an efficient load-bearing structure. In the case of the pavilion, the skeletal structure of the sea urchin is reproduced with a uniform material commonly used in architecture, namely plywood sheets 6.5 mm thick.

Adaptive flexibility of anisotropic structures

An important aspect of forms of construction found in nature is that the chemical and physical properties of the materials involved are matched on a small scale to local requirements. Natural forms of construction are, therefore, highly differentiated not only in respect of their geometry, but also in terms of their material characteristics. In most cases, they consist of fibrous substances like cellulose or collagen with directional properties; i.e. not with an isotropic make-up. Through a combination of different directional lines and packing densities, a large number of finely attuned structural qualities can be achieved. Of particular in-





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terest is the investigation of plant movements such as those observable in the Venus flytrap (ill. 19), which in many cases is controlled only by the locally regulated and adaptive flexibility of its components. Movements of this kind are caused by a change of the liquid pressure in the cells. This approach, based on elastic deformation, is diametrically opposed to the technical solutions for movable forms of construction. In the case of travelling bridges and stadium roofs, the rigid constructional elements or the textile skins are linked and activated by hinges, rollers and other mechanical components. With forms of building construction that are erected as unique models, without prototypes and extensive test runs, this large range of components of different composition often causes problems. These have to be resolved through elaborate experiments on the finished object and result in higher maintenance costs.

The kinetic facade of the One Ocean theme pavilion at the Expo 2012 in Yeosu, South Korea, allows a large-scale elastically deformable construction to be tested (ills. 17, 18). The basis of the technical solution for the biomimetic facade is the use of glass-fibre-reinforced plastic. This material allows large reversible changes of form to be made. On the other hand, its rigidity can be locally controlled by determining the number and orientation of the fibres. A surface

comprising 114 strips was created that changes its form in soft movements. With a length of up to 14 m, a strip has a simple flat section with a thickness of only 8 mm and a bracing rib on one face. At the upper and lower ends of each strip, a compression stress is applied that causes a controlled, elastic bulging deformation. The facade opens up: it can be adapted to obtain the desired lighting conditions and to meet the needs of building physics. In addition, the kinematics allow special, programmed choreographies to be enacted – an eye-catching feature for visitors to the Expo. In order to stabilize the elastic strips when they are subject to heavy wind loads, they are braced against each other in a closed position. The soft edge is thus stretched by means of actuators and pressed on to the rigid edge of the neighbouring strip through the curvature of the facade. The pretensioning applied in this way is gradually matched to the increasing wind load in order to optimize the electrical performance as well as the stresses in the material. The facade of the pavilion in Yeosu is a completely new interpretation of flexible structures. It was achieved with the simplest of manufacturing processes, which have been known for many years: all 114 strips of different length are made with a uniform shape in a hand-lamination method. The decisive factor in terms of innovation in this context is to es-

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- 16, 18 Adaptable strip facade:
One Ocean theme pavilion,
Expo 2012, Yeosu, South Korea
architect: soma;
structural planning of kinetic facade:
Knippers Heibig
Advanced Engineering
17 Principle of deformation through
non-hinged rotation
19 Venus flytrap as a natural model for
adaptable mechanisms

cape from standard thinking patterns and to be stimulated by natural models. The swelling form of the strips in the pavilion is not seen as a failure, as it would normally be in the realm of technology. It is based instead on the model of plants, where large movements can be achieved with a modest influence. Here, too, the technical implementation is possible only with the latest computer-aided methods. What is meant in this case is not 3D modelling nor automatic production technology, but the numeric simulation of non-linear sequences of movement and mechanical stresses in anisotropic composite fibre materials. Information on these have been available to engineering practices for only a short time. This contribution to new forms of architectural construction made by computer-based simulation technology often goes unrecognized.

Outlook

Computer-aided modelling, simulation and production methods thus afford scope for the design and construction of new load-bearing structures of which our knowledge is still in its infancy. Beyond the use of more highly developed technical tools, it is a matter of overcoming fixed routines and patterns of thought. These paths would seem to offer the best opportunity for creating structures that leave the limitations of traditional typologies far behind.



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Steel, Lightweight and Offsite Building Construction



Dramatic steel structure dominates Vienna campus

Following an architectural competition, five international architects have designed the buildings that will make up the new campus of the Vienna University of Economics. At the heart of the campus will be the Library and Learning Centre (the LLC), designed by Zaha Hadid. The 5-storey LLC will rise from the centre of the campus at Leopoldstadt, and a visual highlight will be the arch of the 80 m-long canyon carrier, which will hover apparently free of supports around 17 m above the ground. Part of the construction will be in the form of a figure eight.

The specialist steel-construction company contracted for this prestigious building is the Unger Steel Group, which in addition to its strategic headquarters in Austria also has around 20 subsidiaries in Central and Eastern Europe as well as in the Middle East. The building complex will contain the main library and study centre, student work-stations as well as a large auditorium, which will be the hub of the university. Study services and an IT service department will be provided in the Info Centre. The project is described as having many highlights and a great many technical challenges. The canyon support will be a special steel structure upon which the entire main roof structure will rest. This alone will weigh 350 tonnes,

and will be delivered in eight individual elements, and then assembled on site. The main roof structure will be made of welded steel parts which are up to 2.5 m tall. Concrete tubular steel supports will be attached to the steel beam; the overall assembly will be prestressed, and will be constructed on a flat surface. The finished object is designed to be impressive in its elegance and distinctiveness, with the slender steel beams of the steel structure visible through the glass.

Due to the complex nature of the assembly, the canyon support will be supported by three auxiliary mounting support towers, with secured mounting surfaces in order to be able to withstand the crane loads. A separate, complex assembly design has been developed and converted into detailed instructions. A special 600-tonne mobile crane with a suspended counter-weight will be used to bring the individual parts to the site. Due to their dimensions and weight, these parts will have to be brought into the city at night in special transport convoys.

Logistical preparation and pre-planning has taken around year, with an implementation period of seven months. Installation work started in the spring of 2012, when tempera-

tures were expected to be quite wintry. This in turn necessitated a separate enclosure in which to perform the work. Due to the enormous precision required, all mounting hardware on which the steel structure is set will be carried out only by Unger specialists. A total of 4,000 m² of area will be covered, weighing a total of 1,341 t, with a structure that will be around 30 m high.

The centre will be surrounded by five additional buildings, designed by Hiteshi Abe of Japan, Carmen Pinós of Spain, Eduardo Arroyo of Spain and Peter Cook from the UK. A master plan and master draft incorporating all the buildings have been drawn up by Vienna-based architects BU-Sarchitektur. The Bundesimmobiliengesellschaft (BIG – Austrian Federal Property Association) is responsible for managing the construction project. By mid 2013, the buildings will have a total of 100,000 m² of usable floor space, and the total net cost will be € 492 million. The university will move from Spittelau to the new campus in time for the 2013/2014 academic year.

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Steel lintels

A development of twelve executive style homes has been built using steel lintels manufactured by Catnic. Rivermeade in Welford-on-Avon, near Stratford upon Avon, Warwickshire, is an enclave of six detached properties built by Greenhall Construction for Templeoak. The traditionally constructed dwellings offer four-bedroom accommodation, plus garage with workroom/study above, all built to a high specification.

The developer, Keith Greenhall, comments: "We have used Catnic lintels for many years. They are straightforward to install, and nowadays feature the Duplex anti-corrosion protection." For the Duplex corrosion protection, a coating of thermal setting polyester powder is applied by an electrostatic process. High temperature curing then produces a tough durable surface to enable the product to be highly resistant to impact, abrasion and damage; which enables ease of on-site handling.

For the six properties at Rivermeade, CG90 lintels in various lengths were used, erecting 100 mm Thermalite blockwork inner leaf and fully filling the 100 mm cavity with mineral wool to achieve a U-value of 0.2 W/m²K.

Externally the houses show a stone plinth, with the toe of the lintels either supporting russet brickwork or dense concrete blockwork clad with larch boarding. Each of the properties required more than a dozen of the Catnic lintels, varying in quantity and size depending on layout.

The lintels are manufactured from hot-dipped galvanized steel and are designed, manufactured and tested in accordance with BS EN 845-2:2003 and are certified by the British Board of Agrément.

□ Catnic
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☎ +44 (0)2920 337 900
www.catnic.com



Recycled modular building used for new school

A dedicated sixth form centre is now in use at Wymondham High – a new academy in Norfolk. The scheme has been constructed using a highly sustainable recycled modular building from Foremans Relocatable Building Systems. Designed by architects NPS South East, the single-storey building accommodates five seminar rooms for students studying social sciences, and sixth form facilities, including a break-out area, toilets and administration office.

Louise Robinson, Project Architect at NPS South East said: "This scheme has changed our perception of modular building. It feels robust and secure and has good sound quality – you would never know it is a modular structure. We are impressed with the finish, particularly externally, and the cladding is crisp and well executed."

A collaborative approach was taken to the design of the new building. The most appropriate aesthetic solution for the exterior was discussed at workshops with sixth form design students. Students were keen to use timber from a sustainable source and to introduce colour into the project. The architects worked with Foremans to develop a cladding solution using natural larch with vertical 'windows' cut out to reveal the

modular steel structure finished in colours of jade, heritage green and Wedgewood blue.

All Foremans' recycled modular buildings are fully refurbished with new windows, wall linings, partitions, mechanical and electrical services, doors, flooring, and cladding, to create high quality accommodation for a wide variety of education applications.

The advantages of recycled and refurbished modular buildings for schools, colleges and sixth form centres include: A bespoke design to meet specific project and site requirements, programme times reduced by up to 70 per cent, a highly cost-effective alternative to new build and easily expanding buildings, which can be reconfigured or removed if teaching requirements change. Off-site working is also maximised for safer, quieter and cleaner sites as well as reducing disruption to teaching. High quality steel-framed modular buildings are built to last and require fewer groundworks than traditional site-based construction which further reduces cost, disruption and programme times.

□ Foremans RBS, United Kingdom
☎ +44 (0)1964 544 344
www.foremansbuildings.co.uk



The potential of digital media for architecture

DETAIL
Practice



Digital Processes
ISBN 978-3-0346-0725-4
2011, Moritz Hausschild,
Rüdiger Kartzel.
112 pages with numerous
drawings and photos.
21 x 29.7 cm, Paperback.
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+ postage/packing
+ VAT, if applicable

New planning software and fabrication technologies offer new design options

Today a computer is nearly as much a part of a household as a refrigerator. With its rapid development in recent decades, computer technology has changed the daily life of every individual far more than even utopian thinkers would ever have dared dream. It is thus not surprising that architecture – starting with the drafting stage and continuing through to fabrication – is also subject to ever more digital influences. The spectrum ranges from classic computer programs for drafting and presentation using media-supported drafting processes to computer-controlled fabrication processes, not to mention industrialised bricklaying "robots". From surveying to planning to fabrication, architecture is created today using a tightly coordinated digital process chain. What influence do digital drafting and fabrication methods have on current architecture? To what extent do the new tools change architecture and its development process? What is the potential of digital media for architecture? What options for use and application are available to every office? What advantages do electronic work procedures offer? DETAIL Practice "Digital Processes" provides answers to these and many other questions relating to the digital drafting and construction process.

- Media-supported drafting processes
- Computer-aided fabrication processes
- New options in model building
- Exemplary digital process chains



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Structural facade

VISS SG is a new thermally insulated system from Schueco Jansen, which delivers a stylish 'all-glass' look for structurally glazed facades. Utilising the structural properties of steel, VISS SG facades are characterised by long spans and large glazed areas. With the system being capable of supporting glass panes up to 2.5 m wide x 5.0 m high and weighing up to 800 kg, VISS SG delivers maximum transparency for the building envelope together with excellent 'U' values.

Facades with large module widths are currently a popular architectural style and architects and developers have new options for designing the perfect appearance of a uniform glass surface. The effect is achieved by means of a special toggle and channel system, which holds the glazed unit in place mechanically, without the need for the traditional mullion/transom pressure plate and cover cap profiles. This means that from the outside, only the narrow silicone joints between adjoining units are visible.

The thermally insulated steel mullions and transoms of a VISS SG system can accommodate double- or triple-glazed units up to a thickness of 70 mm and readily fulfil the requirements of current and future proposed Building Regulations. The new system is approved in accordance with ETAG 002 (Guideline for European Technical Approval for Structural Sealant Glazing Systems).

Available in either 50 and 60 mm face widths the system can be combined with any of the VISS profile family including VISS Basic, which can be mounted on any suitable support structure. This allows a wide range of options from a standard range of components.

□ Schueco Jansen
United Kingdom
☎ +44 (0)1908 282 111
www.schueco.com



Edge protection

For the construction of a new BSF Academy for media studies in Birmingham, the steel fabricator and edge protection supplier were brought together at the design stage to determine a cost-effective edge protection solution that satisfied the needs of all trades at every stage of the project.

The project demanded an edge protection system to meet the European Standard, EN 13374 Class A. It needed to be up to 2 m high to contain windblown debris and materials, and required a mesh panel and toe board. It also needed to allow access to the building edge for installation of the cladding system fixing cleats, preferably whilst protecting the cladding installers.

The team decided to use a 2 m high system based upon the Combisafe® SMB (Steel Mesh Barrier). The system could be pre-installed into sockets or bolt holes within the perimeter steel work, thus minimising work at height during installation. By additionally specifying the SMB Beam Holders to be used in all locations, the whole edge protection system attracted substantial additional flexibility. These SMB Beam Holders allow a double guard rail beam to be positioned outside the line of the SMB and to be supported on the same posts. The SMB Beams are put in place over the existing system, whilst at all times the installer is protected from falling by the previously installed SMB. Once the SMB Beam is in place, the SMB panel can be removed from the inside, allowing protected free access to the edge of the building, and allowing the cladding contractor to reach through the SMB Beam to position and fix the cladding cleats. At all times the installers and other trades were collectively prevented from falling, and at no time needed to use a harness and lanyard.

□ Combisafe International Ltd
United Kingdom
☎ +44 (0)1604 660 600
www.combisafe.com



Curtain walling

The Bañeoludique de Gruissan swimming pool and spa complex, a new 2,000 m² sustainable leisure complex in the Languedoc-Roussillon region of France is showcasing a range of facade options created using Technal's Geode-MX aluminium curtain walling suite. The new facility is designed by architects Chabanne & Partners to blend into the surrounding beach and pine forest and to offer protection from the prevailing north east winds. The glazing is designed to provide panoramic views of the stunning landscape.

MX is a complete curtain walling suite, offering specifiers enhanced thermal performance to meet the most stringent Building Regulations, and the widest choice of aesthetic options from a single system. Technal's Geode-MX Trame Vertical faceted system and Geode-MX Visible Grid curtain walling, together with its aluminium casement windows and exterior doors, were specified to enhance the visual appeal of the building and helped to create a transparent facade.

The MX faceted glazing forms undulating concave and convex walls. The curtain walling also varies in height between 4.6 m and 6.2 m and without the need for visually obtrusive intermediate structural supports. The aluminium frames are powder coated for resistance to salt water, chlorine and corrosion and are low maintenance, making them ideal for a coastal site and a swimming pool facility. The facade is also integrated with 100 m² of solar panels that generate renewable energy to provide hot water for the building. In winter, the facade system reduces heat loss and in summer, it prevents over-heating. A U-value for the facade of 1.4 W/m²K was successfully achieved.

□ Technal
United Kingdom
☎ +44 (0)1924 232 323
www.technal.co.uk

The diversity of steel construction in detail

DETAIL
Practice



Building with Steel

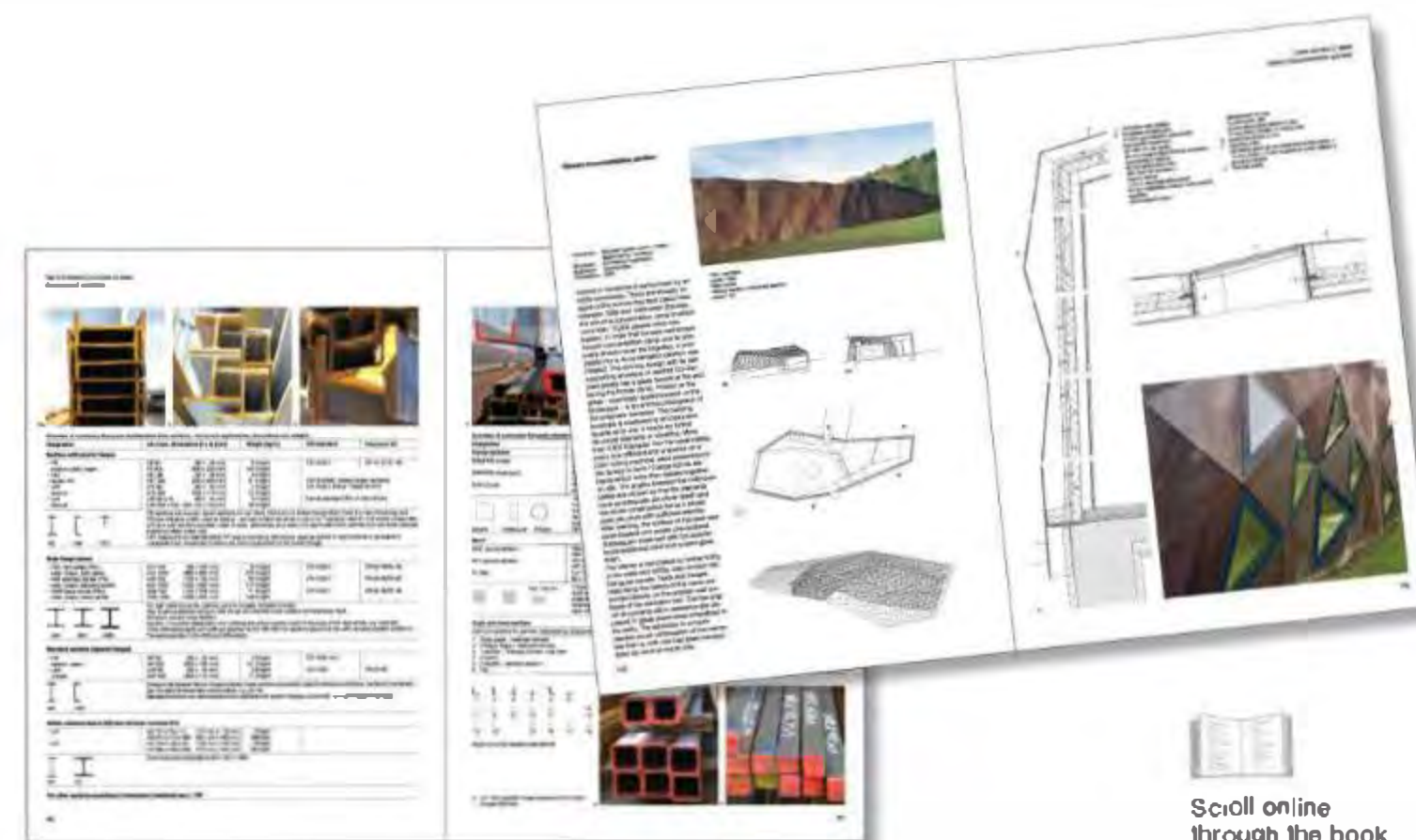
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112 pages with numerous drawings and photos.
21 x 29.7 cm. Paperback.
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+ postage/packing
+ VAT, if applicable

Guide to practical steel construction

Detail Practice »Building with Steel« is a manual for quick, specific reference and implementation. Examples of projects explain useful standard details using large-scale, detailed drawings. The basic principles of support structure help in designing and planning. Common supporting structures are also explained using examples of residential, administration and hall constructions. Fire protection and building physics issues, especially relevant in steel construction, are dealt with, as is the use of steel as a material for facade cladding.

- Common constructions explained step by step using standard details on a scale of 1:10
- Fire protection in steel structures
- Residential, administration and hall structures: selected examples of projects demonstrate the possibilities of steel construction
- Steel structures in renovations
- Overview, profiles, metal sheeting ropes – properties, handling and areas of application



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Major extension

B+K Structures have supplied and erected cross-laminated timber and steel elements to create 11 new classrooms at Holy Trinity primary school, as well as a new staff room and other facilities. Speed of delivery and the ability, as an off-site system, to help attain high standards of airtightness and energy performance were important factors to consider for the project which is on target to achieve a BREEAM rating of 'Excellent'.

London-based sustainable design company, Archtype, was responsible for the original concepts of this major new extension and re-modelling of the school's layout, as well as the choice of a hybrid timber and steel structure as the design solution.

James Todd of Archtype recounts: "The school, which dates from the seventies, is on a tight site and had to remain open throughout the build, so one of the key considerations was to utilise an off-site modular system, offering a fast and quiet erection process. Contractors also recognise the benefit of getting a roof on virtually immediately which enables work to continue away from the outdoor elements."

"For us the use of timber as a renewable resource was also important, with the cross-laminated timber panels making it straightforward to achieve good airtightness. This was crucial because we were working to near Passivhaus standards and designing in mechanical ventilation with heat recovery, as well as a network of ground tubes to pre-warm or pre-cool the air coming in."

The new buildings have been erected as infill to the original cruciform shape, but have been able to integrate the new and the old effectively so that circulation is logical.

□ B+K Structures
United Kingdom
☎ +44 (0)1773 853 400
www.bkstructures.co.uk



Building system for seamless facades

Off-site company, Yorkon, has launched a new building system, following a three-year development and testing programme which has included significant investment in new production facilities in York. The company offers a wide range of building modules giving architects, contractors and construction clients the design flexibility to meet almost any building footprint.

The new building system includes 'invisible' columns, enabling a seamless facade that can be specified with or without cladding. It can fit any building footprint, including those designed for traditional site-based construction.

All connections between modules are now be carried out from inside the building and there is the option of angled corners for further architectural variety. Module lengths are available from 6 to 18.75 m offering greater flexibility and the option of using larger but fewer modules to reduce carriage and transport costs. There are also two module width options of 3 and 3.75 m, three height options for single-storey buildings, and seven different heights for ground and intermediate floors on multi-storey schemes to facilitate linking to existing traditionally-constructed buildings.



Yorkon also offers a wide choice of cladding, glazing and roofing options to create outstanding architecture and landmark buildings or bespoke facilities which complement existing schemes with all the advantages of an off-site construction solution.

These include programme times reduced by up to 50 per cent; 99.5 per cent recycling of waste material in the factory and 92 per cent recycling on site; less disruption during construction; improved thermal efficiency for lower running costs and reduced carbon emissions and much greater assurance of delivery on time and on budget. Commenting on the new building system, Joe Biggs, Managing Director of P+HS Architects, said: "Yorkon recognises the importance of offering flexibility in design and layout to suit individual project requirements, as well as a fast and efficient response."

The new Yorkon off-site building system has many applications, ranging from teaching facilities; hospital buildings to control centres and passenger and operations facilities for railways and airports.

□ Yorkon, United Kingdom
☎ +44 (0)845 2000 123
www.yorkon.co.uk



Low carbon building uses hybrid construction techniques

Elliott Off-Site Building Solutions has completed a new building at Hayes School in Bromley, Kent. Known as M-Block, the building creates a new school library, student support facilities, speech and language class, along with provision of a new modern art facility for Media, English and PE teaching.

The new building achieved a 20 per cent reduction in CO₂ compared to current building regulation requirements. Creating a building with a reduced carbon footprint was achieved using the company's hybrid construction techniques, along with a range of sustainable design features.

As the pre-fabricated components are relatively lightweight compared to conventional brickwork, off-site construction systems are able to help reduce the building's carbon footprint. Such development often requires simpler foundations, making significant savings on high embodied energy masonry based materials. Modern methods of construction also require fewer deliveries to site and create less waste for landfill. A full steel framed system was chosen for the two-storey building, which was pre-fabricated before being delivered to site for rapid assembly. Once the frame had been erected tim-



ber in-fill panels were fixed to the steel structure. The external walls of the school were finished with Sto render and cedar timber cladding. This type of Cedar cladding has a life expectancy of up to 50 years.

Concrete was used for the floors on both levels, which reduces noise transmission. The building has a single ply membrane roof along with aluminium windows and external doors. Other sustainable elements incorporated into the building include maximizing natural daylight through the use of rooflights, and a high-efficiency condensing boiler supplying low pressure hot water (LPHW) heating. Air conditioning to the classrooms is provided by energy-efficient air source heat pumps.

Elliott Off-Site Building Solutions provided the client with complete project management from initial design concepts through to construction, landscaping and handover. The company works with clients to design the building around their needs, using its hybrid construction techniques.

□ Elliott Off-Site Building Solutions
United Kingdom
☎ +44 (0)1274 863221
www.elliottuk.com



Insulated panels

Metsä Wood (formerly Finnforest) is a wood products company delivering service-oriented solutions developed in collaboration with its customers. Its premium solutions are based on ecological, high quality Nordic wood as a raw material.

The new Finnroof system is a complete timber and roof cassette solution, pre-fabricated and fully insulated off-site. Supplied as a site-ready component according to the construction schedule, it arrives to site in a closed, pre-insulated panel format, complete with spaces for rooflights or dormer windows that are simply craned into place on the roof. The system can be installed quickly and minimises working at height during construction.

This is a system suitable for use with both timber frame and masonry structures comprising a vapour barrier, FinnJoist, insulation, sheathing board (OSB) and breather membrane. Once in position on the roof, tile battens can then be fixed in place, together with choice of roof tiles. Plasterboard can be applied with ease to the inside.

Benefits of the system include its speed of installation and cost efficiency. The system also enables sites to be designed in accordance with PPS3, and by making optimum use of the space available to maximise usable living space.

Kevin Riley, Vice President UK Construction Industry for Metsä Wood explains what the implications of the system are for housebuilders: "By creating additional available and saleable space on a plot, housebuilders stand to optimise sales by differentiating their offer, by making available an uninterrupted roof space which can be sold as habitable accommodation."

□ Metsä Wood, United Kingdom
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www.metsawood.co.uk

Roofing and Drainage



Membrane acts as structural component of stadium roof

The complex assembly of the roof construction at Kiev's football stadium was a recent operation planned by Radolfzell-based engineering consultants, FormTL. The Red Stadium built in 1923 for the second All-Ukrainian Olympic Games is now called the Olimpijski National Sports Complex, and been completely renovated. The supports for its new roof were positioned outside the existing upper-tier stand made of reinforced concrete.

The 45,000-m² filigree, translucent membrane roof features 640 high points with light domes, lending the construction a discreet radiance and providing spectator terraces suffused with daylight. The roof-support structure is a membrane-spanned, spoked-wheel construction with two outer pressure rings and a pull ring on the pitch side made of VVS cable clusters, between which 80 radial cable trusses are spanned. The lower cable of the trusses slope outwards and bear 80 membrane fields made of PTFE glass fibre. Each membrane bay is undulated by eight high points suspended by cables. The final concept involved pre-assembling the ring cables, radial cables, and knots on the ground, then lifting them up to the upper pressure ring and finally pre-tensioning the lower radial cables. The upper

radial cables had to be pulled up equally to the upper pressure ring on all 80 axes in order to avoid overstress in the cable-support structure. To this end, couples of low-pressure mounting jacks were placed on the upper pressure ring on each axis. Each lifting pair was fitted with its own pumping unit; in this way, adjacent forces were separated individually for all axes and controlled centrally. Despite a load level that varied locally and fluctuated during the lifting process, the clamping devices were set up so as to avoid any sizeable geometric or unchecked distortions appearing during assembly. Using hydraulic cylinders placed in pairs, the cable net was tightened at the lower radial cable and then bolted with the lower pressure ring.

The membrane at the Olimpijski Stadium is a structural component that stabilises the air supports. Therefore, it was essential to determine the membrane's exact rigidity in order to ascertain the cut sizes. In the form-finding process particular care had to be taken with the stress level under snow load. The roof surface had to meet at least fire-protection classification B1 in accordance with DIN 4102 and the stands had to be as light as day, therefore ETFE sheets were chosen to cover the high points. The key

determining factor was their short delivery, and assembly times. To ensure optimum digital generation and industrial manufacture of the membrane bays, the company added the project-specific requirements to the inheritance software (WinNetz!). In this way, the manufacturer was able to import all layout data relating to the 11,000 patterns and 11,000 reinforcements directly into the nesting and cutting process.

During assembly, the 80 pre-manufactured membrane bays were raised to the lower pressure ring. From there, the membranes were spread out over the pre-mounted air supports, which at this stage were lower, and subsequently coupled up all around. Afterwards the eight air supports per field were raised and anchored using the original suspension cables.

The final prestress was applied with hydraulic jacks. Lastly, a cableway installed temporarily between the tension ring and the upper compression ring raised the pre-assembled ETFE domes to their place of installation.

□ FormTL, Germany
☎ +49 (0)7732 9464 40
www.Form-TL.de



An indispensable aid for constructing flat roofs

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Manuals

Flat Roof Construction Manual

MATERIALS
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SCHUNCK
BARTHEL
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Flat Roof Construction Manual

2010. Klaus Sedlbauer, Eberhard Schunck, Rainer Barthel, Hartwig Künzel.
208 pages, including numerous pictures and drawings.
23 x 29.7 cm. Paperback.
€ 79.90 / £ 66.50 / US\$ 106.–
+ postage/packing
+VAT, if applicable

A reference work on types of uses and constructions of the "fifth facade"

The flat roof, beloved by architects and often described as 'the fifth facade', is designed mainly to protect the space beneath it from the weather. Integrating a flat roof, whether as a green roof terrace, publicly-accessible area or even as a profitable solar panel roof, optimises the profits and benefits derived from the building. Because professional implementation of such roofs is in practice not always as simple as it sounds, this publication provides planners with the basic rules of construction and an overview of the kinds of uses and constructions and standards for flat roofs. In addition to the most important norms, rules and standards, construction plans of the main connection points round out this publication.

- Planning-related basics on the construction, materials and building physics of flat roofs
- Detailed presentation of individual layers of construction and roof types
- Flat roofs as accessible areas
- Renovating flat roofs
- The most important details on building flat roofs and connection points as a basis for planning
- Clear descriptions of construction solutions showing built examples



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Fibre cement

A £2.2 million school extension and refurbishment project features a combination of two of Marley Eternit's fibre cement slate styles, the Birkdale in Heather colour and Thrutone in Blue Black. Designed to give an aesthetically pleasing, lightweight, strong and durable roofing solution, these products have enabled the new design to settle seamlessly into the local built environment and supported the delivery of the project's environmental objectives says the company.

As part of Bridgend County Borough Council's ongoing school modernisation programme, the project at Litchard Primary School has seen the merging of the infant and junior school buildings, and the slates were used to cover an area of 1,000 m² on the link building that joins the two together, to create a single structure.

Said Phil Watts, senior architectural assistant at the borough council: "The extension link between the junior and infant schools was an important part of the scheme as it allows the school staff and pupils to benefit from a single integrated structure. We wanted to utilise a roofing solution that provided aesthetic appeal at a competitive price. Marley's range of fibre cement slates ticked the boxes in both cases and the colour choice has meant we could match and complement the existing buildings extremely well. The use of the two colours works well side by side."

The slates achieve an A+ rating in the BRE Green Guide to Specification, and have recently been certified to a 'Good' rating in the BES 6001 framework standard for Responsible Sourcing of Construction Products. This project is also currently on target to achieve a BREEAM 'Very Good' rating.

□ Marley Eternit
United Kingdom
☎ +44 (0)1283 722 588
www.marleyeternit.co.uk



Fast installation

SpeedDeck Building Systems supplied S&G Industrial Roofing with its SpeedDeck® standing seam secret fix roofing system for a recent contract that involved a roof area of 5,555 m².

The roof profile was manufactured on site at the eaves of the building within three days and installed six days later.

The company supplies both 'zip up' standing seam roof profiles, which offer specifiers the option of tapered solutions, and the alternative secret fix roofing system used on this project, which features double interlocking ribs and clips to ensure strength, watertight integrity and a fast installation process.

Sean Partridge, senior director of S&G Industrial Roofing, commented that if a 'zip up' standing seam roof profile had been chosen for this job then a further three weeks of installation would have been required and plant would have had to remain on site for longer, thereby further increasing costs.

SpeedDeck secret fix system is supplied in both aluminium and steel material with the additional benefit of on-site rolling, which meant significant savings on transportation costs for materials on site, as this would have incurred approximately eight lorry loads under police escort due to the length of material.

Says Partridge, "If we had been hoisting materials from the floor, 51 m-long sheets, we would not have been able to crane lift the sheets due to adverse wind conditions, thus incurring us extra costs for crane hire and down time. This also bodes well for the architect's BREEAM credits."

□ SpeedDeck Building Systems Ltd
United Kingdom
☎ +44 (0)1379 788 166
www.speeddeck.com



NOx-neutralising

Icopal has recently supplied its Eco Activ solution, Noxite, to Bron Afon Community Housing to re-roof 170 homes in Northville, Torfaen. The roofing solution was installed by FeltFab Facilities.

Bron Afon Community Housing, is currently bringing its housing stock up to the Welsh Housing Quality Standard which includes improving the energy efficiency of tenants and leaseholders' homes, as well as reducing toxic emissions.

The Noxite roofing solution uses sustainable construction technology to depollute and neutralise the air from NOx particles. Nitrogen oxide (NOx), a harmful by-product of fossil fuel combustion from industry and vehicle emissions, is turned into harmless nitrates using the innovative roofing membrane technology. The system, which provides a positive effect on the atmosphere, removes toxic pollutants and generates a cleaner, healthier environment with significantly improved air quality. The roofing membrane contains special grades of titanium dioxide (TiO₂), which stimulates the neutralising process.

The system, part of Icopal's Eco Activ range, includes a Total torch-on vapour control layer (VCL), Thermazone insulation board, Total Torch vapour dispersion layer (VDL) and Noxite de-polluting cap sheet.

Richard Llewellyn, FeltFab Facilities Ltd's Business Development Manager commented, "During the contract award process we were required to present our proposals for the scheme Noxite was accepted at this stage based on its clear environmental advantages over other flexible roofing solutions."

□ Icopal
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☎ +44 (0)161 865 444
www.icopal.co.uk



Atrium glazing

Hartlepool College of Further Education has been given a new £53m aluminium roof glazing system using Wicona's Wictec 50. This striking college campus was designed by Bond Bryan Architects and built by Miller Construction. The scheme comprises two blocks which are linked by a full height atrium created with Wicona roof glazing and forming the main entrance and circulation space.

The central atrium has a complex fan-shaped roof which uses faceted glazing that radiates outwards and follows the curve of the building. The roof glazing system is sufficiently robust to carry large unsupported spans of glass up to 2.3 m wide – 6 mm solar control toughened glass for the outer pane with up to 8.8 mm clear laminated inner panes.

Two mono-pitch glazed roofs with a 15° incline were specified for the north and east wings, with automated roof lights to the vertical areas to provide natural ventilation when needed.

Some other features of the system are it is simple to fabricate and install; saving time on site; it is engineered for the creation of large unsupported spans; it is sufficiently robust to meet specific project requirements for glazed roofs such as wind and snow loads, plus it is a dry glazed system which will achieve water tightness without any reliance on sealants and has a Fire Rating to 30 minutes with the Wictec 50 FP option.

The company offers a range of technically advanced facade systems which now includes unitised and stick curtain walling, structural and roof glazing, highly insulated window systems and heavy duty doors.

□ Wicona
United Kingdom
☎ +44 (0)845 602 8799
www.wicona.co.uk



Type 63 T Renova roof drain

Flat roof renovation - the Dallmer way

Simple.

The old roof drain stays in place and the new one is pushed through as far to the level of the new membrane, right into the existing downpipe.

Secure.

The flexible lip seals ensure a firm fit and even out irregularities in the old drain. At the same time they guarantee the necessary backflow resistance. The additional stainless steel clamp ring for the 63 T DallBit guarantees maximum resistance to wind load and prevents loosening of the roof membrane from the drain.

Tight-fitting.

The Renova roof drain 63 T fits inside all standard downpipe sizes. The body of our Renova roof drain 63 T is so compact that it can be fitted in virtually all old drains without difficulty. It is ideal for renovation projects involving either the laying of new roof membrane or extra layers of insulation.

More information? A call or a click away at:
01787 248244, info@dallmer.com or www.dallmer.com

DALLMER
drainage by design!



Passivhaus component

As part of plans to upgrade their 3-bed, 1952 detached home to incorporate PassivHaus components, Tina Holt and Richard Middup are working to the EnerPHit standard for a quality retrofit and loft conversion.

EnerPHit requirements specify the use of suitable triple-glazed windows as part of plans to achieve a whole house space heating total of less than 40 kWh per square metre per year.

The Fakro FTT U8 Thermo® quadruple-glazed roof window was chosen for its U-value of 0.58 W/m²K. These highly-energy efficient roof windows have been designed taking into account the stringent requirements of passive construction. The special design provides excellent performance by ensuring high efficiency of thermal energy. The window is supplied and installed in conjunction with EHV-AT Thermo flashing. This major contribution to super-insulated and airtight construction is achieved using thermally efficient glazing, a quadruple seal system and internal laminated pane to Class P2A. Its large dimensions and raised pivot point provide ample light in the loft and unobstructed access to the open window. It also features a modified locking system without the traditional locking assembly. After turning the handle, the sash is securely locked in two sides of the frame.

The window glazing unit is set in a specially designed sash frame, utilising thicker timber profiles, thus reducing the risk of thermal bridging and improving the overall thermal performance of the structure. The window is opened via raised pivot. The open sash can be stopped anywhere between 0° and 40°, thanks to a new support mechanism holding the sash in place within this range.

□ Fakro
United Kingdom
☎ +44 (0)845 021 3030
www.fakro.co.uk



Waterproof membrane

Warrington-based Kemper System has helped to restore Marine Hall in Fleetwood, following damage to the roof. The company's waterproof membrane has been used to protect the roof.

The building features two covered esplanades leading off from the central, circular building, with columns supporting an 800m² flat roof. The existing flat roof was leaking with water ingress causing damage to the timber decking below the existing bituminous sheet waterproofing, so Wyre Council approached contractor, Castle Contractors, to upgrade the roof.

The roof was stripped and the damaged timber decking was replaced ready for the installation of a new waterproof membrane. Kemper System's 'D' Primer was used before applying Kemperol V210 to the new roof deck. The cold liquid resin saturates a non-woven reinforcement fleece that is tailored to the exact contours and details of the roof on-site. The waterproofing is installed in a single process and cures to provide a durable, flexible waterproof membrane which bonds directly to the roof substrate. It provides a seamless, elastomeric, UV-stable membrane that cannot delaminate. This offers distinct advantages over partially bonded, layered liquid, sheet membrane, or hot-applied materials.

Mark Atherton from Castle Contractors comments: "The Marine Hall in Fleetwood is in an exposed location where heavy rain, high winds, UV and damp, salty air are all specification considerations. Kemperol V210's track record means that we can be confident that it will perform in these marine conditions to provide a minimum service life of twenty five years."

□ Kemper System
United Kingdom
☎ +44 (0)1925 445 532
www.kemper-system.com



Vapour control

A new vapour control layer for optimal airtightness in the building envelope, DuPont™ AirGuard® Smart further extends the existing AirGuard® product range, suitable for both roof and wall applications. This solution is said by the company to deliver superior performance in terms of moisture management through its capacity to 'behave smartly' according to weather conditions, relative air and insulation humidity. The wide vapour resistance span, from 0.26 to more than 150 MNs/g, is claimed to offer excellent adaptability to changes in humidity levels, which allows maximum protection against structural damage.

Developed for new build and refurbishment projects, the membrane is specifically designed for renovating roofs from the exterior. Applications include above rafter insulation or between rafter insulation, but it can be also used in dry lining applications from the inside. It adapts to changes in humidity levels and minimises or increases the water vapour transmission rate, as needed. The vapour resistance is always below 5 MNs/g if the insulation is very wet, regardless of ambient air relative humidity.

The construction and insulation can dry out to the inside, as well as to the outside via the Tyvek® breather membrane. Very high relative ambient air humidity should additionally be reduced through ventilation and extraction.

The product acts as a typical vapour control layer if the insulation is very dry: it provides a vapour control effect with a high vapour resistance. These features are designed to make it an ideal solution for energy-saving requirements and to contribute to cost reductions related to heating or cooling.

□ DuPont AirGuard
United Kingdom
☎ +44 (0)1275 337 660
www.tyvek.co.uk



Safety solution

Easi-Dec offers a range of safety solutions to those accessing fragile industrial roofs, to eliminate the possibility of roof top accidents. The company's range of roof access equipment includes Board-Walk, a portable mesh walkway. Running from the eaves to ridge, the system spreads the weight across the support battens, allowing the workers to confidently move along the full length of the system. Made of high grade aluminium, the structure is lightweight, easily transportable and can be used on roof pitches up to 30 degrees.

Roof-Walk is a fully guarded rolling platform, mounted on twin racks to allow workers to move up and down the roof on a secure and level surface. Requiring no penetration, the structure is easy to assemble and dismantle, and can be transported quickly to other parts of the roof. A 4.6 m platform comes as standard, with a 2.5 m alternative also available. This moves along a linking track which is fitted with safety mesh and battens to provide further support.

Completing the range is Valley-Walk, a lightweight mobile walking frame designed to provide safe access for one or two people when working along valley gutters. The outriggers are filled with safety mesh and cushioned for comfort. This system can also be used to transport light payloads. Suitable for typical symmetrical valleys, it can also be fully adjustable to suit uneven designs.

The company designs equipment that is safe, simple and robust for use on site in compliance with all current regulations. The range encompasses solar array installation systems, roof access platforms including engineered walkways, edge protection and ladder safety products.

□ Easi-Dec Access Systems
United Kingdom
☎ +44 (0)1767 691 812
www.easi-dec.co.uk



Recyclable rectangular rainwater systems

Combining sleek aesthetics with a superior flow rate, products from Marley Alutec's stylish and highly sustainable range of rainwater systems have been installed in a new extension at one of Scotland's premier wedding venues, the Lochside House Hotel in Cumnock, Ayrshire.

The Alutec Evolve Box system with the 72 mm Traditional Downpipe is one of the latest additions to Marley Alutec's range. The contemporary aluminium box profile, which features concealed top fixing brackets, offers a sleek alternative to the more traditional curved profile, making it perfect for modern building designs. It is particularly suitable for projects where a very high capacity is required, as the Evolve Box system has a



maximum flow rate of seven litres per second, which greatly reduces the number of downpipes required. The system's JuraJoint is a method of joining aluminium gutter through a combination of a rubber seal and Alutec sealant, so when the joint is put together it bonds instantly, resulting in a trouble-free performance and a guarantee of a leak free joint. As with all products in the Evolve range, the box profile is extremely durable and lightweight with a life expectancy of more than 50 years. The nature of aluminium makes it an ideal material for rainwater systems as it resists corrosion.

□ Marley Alutec, United Kingdom
☎ +44 (0)1234 359 438
www.marleyalutec.co.uk



KVH®, DUOBALKEN® AND TRIOBALKEN®

KVH®, Duobalken® and Triobalken® are top-quality and cost-efficient building materials for applications with modern wooden structures.

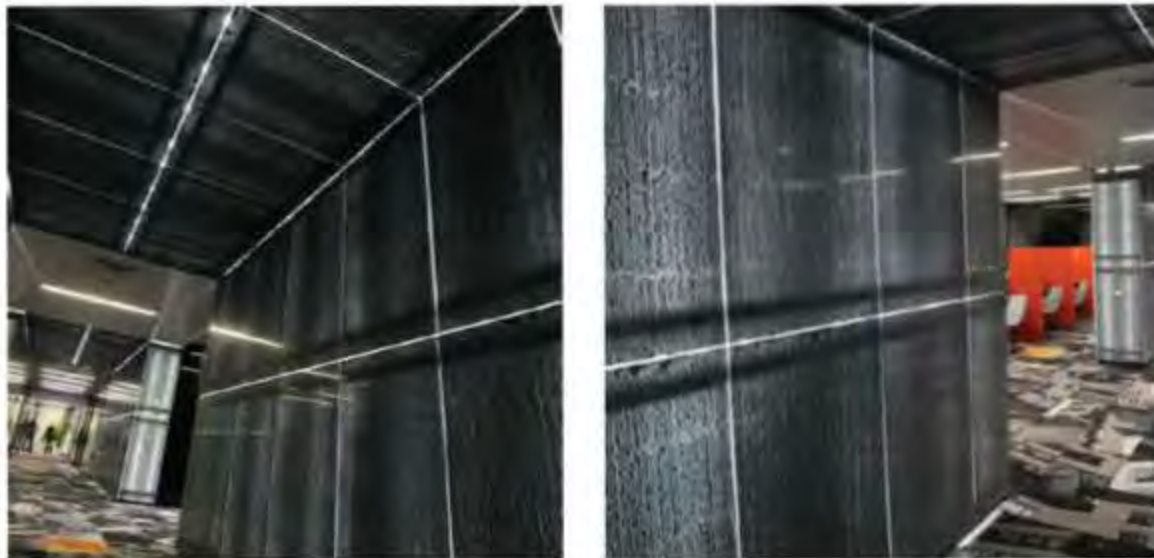
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Email: info-uk@kvh.de
www.finger-jointed-timber.com
www.dun-beams.com, www.trio-beams.com



Refurbishment



Letting the light back into the office with optical fibres embedded in concrete panels

Lucem light-transmitting concrete panels from Telling Architectural feature extensively in a recently completed building project in the Eastern European state of Georgia, at Tbilisi. A derelict 1970s listed building has been renovated for use by the Bank of Georgia as its new headquarters. The 11,000 m² office space consists of five horizontal two-storey structures arranged as stacks and based on a 'space city' concept, the idea being to leave the landscape intact by breaking up the structure and elevating it from the ground. The original buildings, by George Chakhava and Zurab Jalaghania for the Soviet Ministry of Roads in Tbilisi, were designed with the concept of incorporating nature into the whole interior with the use of light – all the rooms were left open plan to let light flood through and so improve the wellbeing and comfort of office users. Architects AG&P went back to this main architectural theme for the renovation and have incorporated 300 m² of light-transmitting concrete panels, using them for wall and counter claddings, walkways, reception areas, offices and consultation desks.

The panels are made from crushed marble aggregate, white cement and thousands of embedded optical fibres through which natural and artificial light can penetrate. Used

for a facade or an inside wall, a flooring system, for wall cladding and even washroom basins and furniture, or purely as a decorative element, they are designed to combine the versatility of concrete with the attraction of light shining through. On this project for example, the walls in the asset management department have been clad with anthracite-coloured panels, while the walk-in cube in the teller's office on the ground floor lobby looks particularly impressive, lined totally with white panels.

Described as durable and hard wearing, resistant to weather, UV and impact, and non-flammable, they can be used internally and externally for new build and refurbishment projects. They come in polished, sheen and matt finishes, in white, grey or anthracite, with special colours available on request, and in different formats. Available in the UK through Telling, the Lucem Line panels, with a fine-meshed structure of light-transmitting fibres, offer an impression of a lightweight structure that, in conjunction with illumination, elegantly reveals silhouetted objects. The Starlight panels feature fibres of different diameters with irregular distances between them so that the single light points appear brighter, giving the impression of a starlit night. The concrete material disap-

pears into the background. A third option, named Label, is designed to allow the fibres to be arranged in logos, names or icons for an individual and distinctive appearance. The company also offers a sophisticated mounting system for high-efficiency LEDs as the light source. The light-transmitting concrete panels are manufactured in a standard size of 1,200 x 600 mm and can be supplied untrimmed or with machined edges in thicknesses of 15 and 30 mm. The panels are calibrated and polished and can be cut to shape with high-precision water-jet cutting.

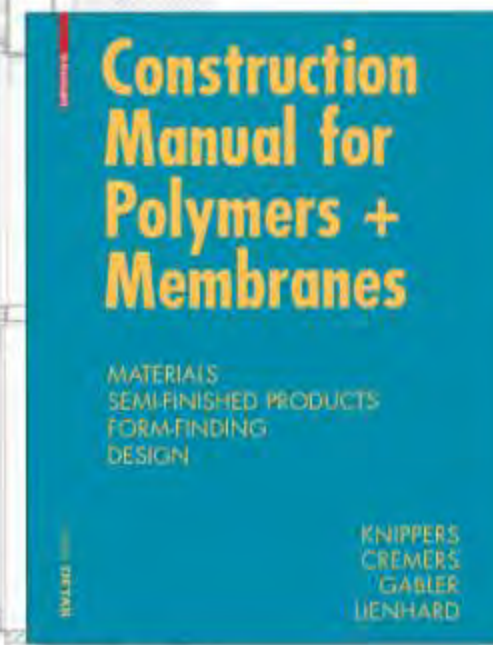
Mounting of the panels is said to be similar to that for natural stone, with installation possible by face fixing, undercut anchor or dowel. Telling Architectural can assist in selecting the best mounting and lighting system to suit the individual project and will also give advice on the product's application and diversity in use. A comprehensive support service throughout the planning, processing and manufacturing is available and in selected cases the company can provide installation services.

□ Telling Architectural Ltd, UK
☎ +44 (0)1902 797 700
www.telling.co.uk



The basics of construction with synthetic materials

DETAIL
Construction
Manuals



Construction Manual for Polymers + Membranes

ISBN 978-3-0346-0726-1

2011, Jan Knippers, Jan Cremers, Markus Gabler, Julian Lienhard, 296 pages, including numerous pictures and drawings, 23 x 29.7 cm, Paperback, € 89.90/£ 74.60/US\$ 119.– + postage/packing + VAT, if applicable

From transparent to translucent – new construction options with a versatile material

Whether as translucent tiling, wide-spanning membranes, air-filled foil cushions or in organically curved form: Plastics are used in architecture in the widest variety of forms and application areas. Innovative technical developments constantly improve their material properties. Plastics today are an alternative to be taken seriously in the building trade, whether they are used in the supporting structure, roof, facade or interior furnishings. The "Construction Manual for Polymers + Membranes" returns to the basics of the series by addressing an individual building material. From the material properties to the requirements for drafting and construction, it encapsulates well-founded and comprehensive expertise in familiar DETAIL quality. Selected project examples complete the reference work and make it indispensable for day-to-day planning.

- Historical development of plastics and membranes in architecture
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- Form finding and calculation of plastic supporting structures and membranes
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Scroll online
through the book



New entrance hall floor lowered 1 m at National Museum of Scotland

Saint-Gobain Weber's Low Dust and Mould Stop Technologies have been used in the restoration programme of the National Museum of Scotland, Edinburgh. The £47 million, three year project by Gareth Hoskins Architects, has seen a complete reconfiguration of the internal space. The museum is now accessed at street level by a new vaulted entry hall rather than the original flight of stone steps leading from Chambers Street.

In transforming the vaulted entrance hall, previously a mess of storage areas, the entire sandstone floor was reduced by over a metre, requiring extensive underpinning of the walls that take the load of the Grand Gallery above.

Plunkett Tiling was contracted to undertake 3000 m² of work to the entrance hall, Grand Gallery, and the show-piece staircases

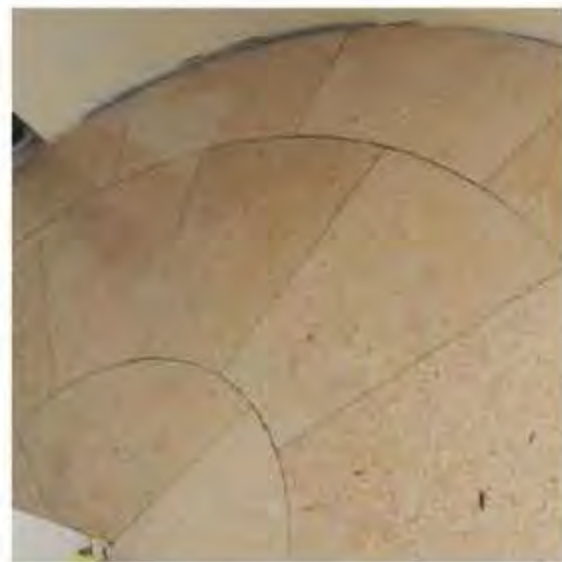
leading off the Gallery, using natural Jura Beige limestone tiles. Steven Allsopp, Contracts Director of Plunkett Tiling commented: We are delighted with the contribution our team has made in the restoration of Robert Matheson and Francis Fowke's 1866 Victorian creation. We had six of our most experienced and skilled fixers on this project. Together we have laid 2,500 m² of 20 mm thick limestone slabs to the galleries, fixed to a sand and cement screed, and 90 mm thick limestone stair treads which were drilled and fixed to steel. There are radial features on six half landings which took very precise application," states Allsopp.

Plunkett Tiling specified the use of 40 tonnes of Saint-Gobain Weber set rapid SPF with Low Dust Technology (LDT), which reduces airborne dust created during the pouring and preparation of products and contributes to a more comfortable and

cleaner environment for tile contractors and their customers. Also used in this application was Weber joint fine flex, a water-repellent, mould resistant, flexible tile grout for interior and exterior use. Suitable in situations where some movement or vibration is expected, it is also enhanced with the company's Mould Stop Technology for lasting protection from mould growth.

The alteration of the museum's interior space is part of the plan to encourage discovery starting from the top of the building. Only 5% of visitors ever explored the top floor which is now accessed by new stairs, glass lifts and escalators which invite visitors to follow them upwards.

Saint-Gobain Weber
United Kingdom
☎ +44 (0)1525 718 877
www.saint-gobain.co.uk



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Lischer Partner Architekten Planer AG

DETAIL Reader Prize: Platform of Arts and Creativity, Guimarães, Portugal
Pitágoras - Arquitectura e Engenharia Integradas, Lda

The winners are being presented online at www.detail.de/detailprize

We would like to thank our readers for their generous support in selecting the winner of the DETAIL Reader Prize!

Institut für internationale Architektur-Dokumentation GmbH & Co. KG, Hackerbrücke 6, 80335 München, Germany



GARTNER



Steel windows

Clement Windows offers a wide range of steel windows suited to each type of building, and provides a bespoke design service to help clients make the right design choices for each project.

A range of six window systems are available, including the W20, SMW, as well as the E24 which is exclusive to Clement. The company also offers a number of alternatives for glazing, handles, locking system frame profile, fittings and colour.

Clients in a city location may prefer the security of a multi-point locking system that meets the demanding BS 7950 standard. Alternatively, for clients in a conservation area, installing new window frames that match the dimensions of original windows may be essential to meeting planning requirements.

Available with Clear Glazing, Rectangular, Diamond Leaded glass, Georgian Welded or Georgian Fenestra Joints, all designs are offered in a range of heritage RAL colours, in keeping with the desired look of the property. The windows can also be supplied in a single or dual-colour finish, where the steel frame is painted one colour internally and another colour externally.

Peter Couldery, Managing Director of Clement Windows commented: "Our bespoke design service helps architects and residential clients to make the right design choices for their project. Investing in great windows can make a big difference to a property's look, performance and value."

Windows by Clement have been installed across a whole host of residential and commercial projects, including new build, listed and heritage properties.

□ Clement Windows
United Kingdom
☎ +44 (0)1428 643 393
www.clementwindows.co.uk



Conservation fenestration with modern performance

Mumford & Wood has designed and installed ConservationTM timber sash windows, casements, external doors, doorsets and special shaped windows for the new Prioory Court classroom block at New Hall School, an independent school in Essex.

Tew & Smith Architects of Northampton worked with contractor Cadman Construction of Colchester, Essex over the two-year project which was completed in 2010.

The company's high performance products, made from clear-grade, laminated larch or oak, were architecturally specified for the new classroom block which is adjacent to the Grade I listed Palace building and the surrounding historic park and gardens.

The Conservation range is manufactured with factory fitted double glazing and three coats of white paint as standard. All products are hand crafted and go through a series of sanding processes to achieve a traditional look. The resulting windows and doors offer all the high performance features of a modern product, whilst retaining the appearance and classic feature lines of original single glazed sashes and doors.

High acoustic performance was required of the window specification, as befits a school environment with upwards of 1,000 pupils. Working closely with gasket, acoustic and glazing specialists, Mumford & Wood has developed acoustic variations of 38dB(A) for Conservation casements and 36dB(A) for sash and box sash windows.

The Conservation box sash is the premier sash window product combining historical detail with modern standards of living. The sashes are operated on cords and weights with brass or chrome-faced pulleys. Double glazing and weather sealing is incorporated while maintaining traditional sightlines and with a choice of slender glazing bars to choose from. All of its timber windows are

made to order, allowing the company to make sizes and designs as required for each individual project.

Conservation entrance doors installed at New Hall were made to measure with decorative fanlights. The company used traditional mortice and tenon joints, and a 57 mm thick leaf within a substantial 68 mm frame for ultimate strength and stability which features a Secured by Design PAS 23/24 approved multi-point locking system.

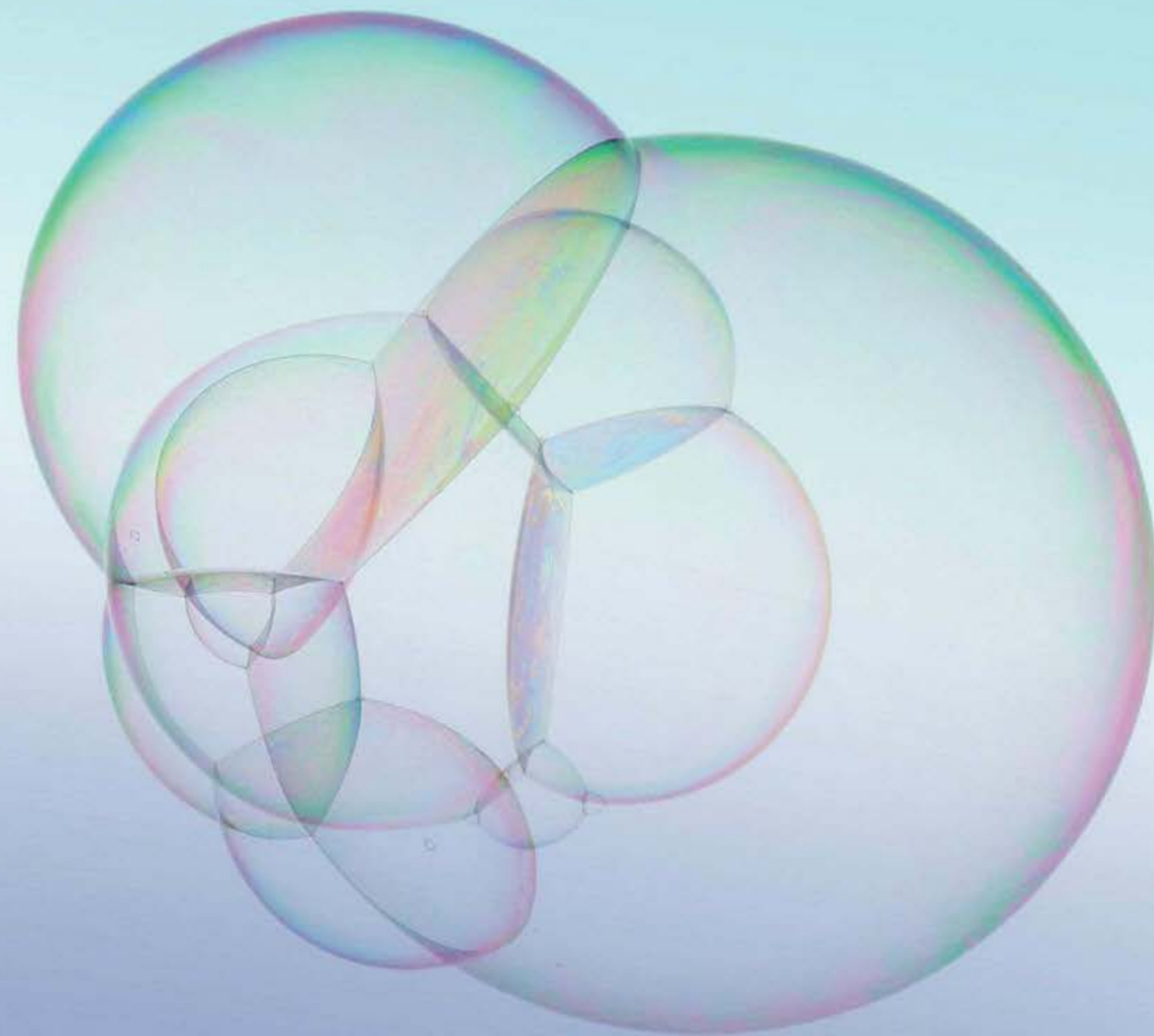
Conservation French Doorsets and single doors offer traditional elegant sightlines while incorporating double glazing, weather sealing and a selection of slender glazing bar options. The doors are supplied factory hung with an espagnolette locking system.

Installation was an important element of the brief and Mumford & Wood was able to provide installation teams from a register of approved installers who ensure work is carried out to the most exacting standards of workmanship. Delivery of over 90 Conservation products, in four consignments, met the critical schedule and installation work was essentially carried out during New Hall's school holiday calendar to avoid any disruption or impact to pupils and staff.

Windows and doors in the company's Conservation range carry the BSI Kitemark and are Energy Saving Trust approved. Many products in the range are Secured by Design accredited.

The company is a member of PWG which also encompasses the leading timber fenestration brands of Timber Windows, Dale Windows, Clearwood and The English Glasshouse.

□ Mumford & Wood
United Kingdom
☎ +44 (0)1621 818 155
www.mumfordwood.com



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Interior Design



Nightclub takes colour and light theme from its local setting

The launch of the Kismet nightclub in India is the recent project of UK design agency Blacksheep. It incorporates a VIP area and private function rooms, all set within a newly built hotel, The Park Hyderabad, on the lakeside in Hyderabad in Central India. The hotel is designed in a highly contemporary architectural style, and the client's brief was to create a space within it that would reflect the energy and drive of this vibrant and progressive city.

The central bar is of Corian, giving a smooth, sculptural appearance with inbuilt lighting providing a dramatic focal point for both areas. Distinctive hexagonal lighting units embedded in the ceiling around the bar were inspired by local Nizam jewellery designs. The agency wanted to celebrate the local tradition of jewellery-making by weaving this into the concept. The club dance floor is equipped with music-synchronised lighting and has a large booth at each

corner lit by chandeliers sourced from a local market.

□ 3form, Netherlands
+31 (0)883 367 600
www.3form.eu

□ Blacksheep
United Kingdom
+44 (0)20 7713 7413
www.blacksheep.uk.com



Fluid layouts for seating areas for commercial and residential projects

The Grato modular sofa from Brunner is described as a 'fluid solution for dynamic environments' and its design and choice of colours makes it suitable for furnishing many different types of interiors. The sofa consists of individual elements that can be combined in any configuration together with corner elements to achieve the desired arrangement: inside corner element, outside corner element, two-seater and three-seater. End elements can also be fitted with an arm-rest.

The flexible seat doesn't rigidly impose a posture and, thanks to the modular design and broad colour range, it's suitable for furnishing many spaces. The elements can be used singly or together to create comfortable seating in informal settings for everyday situations, for example in areas where people are waiting for appointments, taking coffee breaks or just for relaxing. The furniture is designed to appear inviting while at the same time creating an impression, even in a



classic reception area, where the individual elements lend themselves to original shapes and arrangements that are adaptable for a variety of spaces. While offering flexible seating for offices, hotels, museums and waiting areas, this sofa would also fit into the context of a contemporary home.

□ Brunner GmbH, Germany
+49 (0)7844 402-0
www.brunner-group.com

Royde & Tucker has raised the standard for aesthetics in architectural ironmongery with the launch of a new range of decorative finishes on HI-LOAD hinges.

Standard finishes include Antique Brass, Old Bronze, Burnished Nickel, or project specific finishes can be produced using R&T's range of in-house applied finishing processes. These include plating, patinating, powder coated and wet lacquer applications, all of which are available on a stainless steel substrate, ensuring fire certification is not compromised.

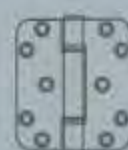
This opens up a new realm of bespoke possibilities for specifiers seeking the utmost attention to finish detail.

HI-LOAD hinges are designed for longevity as a 'fit-and-forget' solution and are maintenance free. HI-LOAD hinges have a 25 year performance guarantee.

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Sofa collection additions

Evan is a contemporary leather modular sofa from Calia Italia and the latest model in the manufacturer's Emporio collection. Described as a blend of comfort and technology, the new sofa, shown here, boasts wide proportions that adapt to cater for specific needs with the aid of two manual and easy-to-use mechanisms. The back cushions can be pushed further back, thus modifying the depth of the seats to a maximum of 1,490 mm, allowing for positions of complete relaxation. The height of the arms can also be modified to suit the user.

The sofa is available in different dimensions and its modular nature allows it to be combined in various ways to provide a multitude of different seating options, from side-by-side positioning to provide long runs, to pairing pieces opposite one another. Evan has great flexibility and can be used simply as a sofa, a sectional sofa or a chaise longue. The choice of colours and coverings – leather on its own or in combination with fabrics and microfibres – together with polished steel feet aid the flexibility for many a design scheme. The frame is pinewood, multi-layer and polyurethane foam-covered chipboard, while seat, arm and back padding are polyester-covered ecological polyurethane foam.

A new entry to the company's Urbana range has also been announced: The Jagger is a modern-style sofa with an electrical mechanism, which at the touch of a button converts into a recliner with footrest and headrest. This also comes in a wide choice of coverings, mixing leather and fabric as desired. In addition, the company offers a range of stylish sofas in its Night & Day collection, which comprises traditional and modular sofa arrangements.

□ Calia Trade SpA
Italy
☎ +39 0835 303 563
www.caliaitalia.com



Staircase echoes 1920s cruise liners' glamour

Yorkshire-based company Bisca specialises in creating bespoke staircases and balustrades. Curved, cantilevered, spiral or suspended, these are designed and engineered in a variety of materials including glass, steel, wood and stone – the company name is actually an acronym for brass, iron, steel, copper and aluminium. Run by designer Richard McLane, the company's work is concentrated on designing and making stairs a focal point for a given space and works of art in their own right.

A recent project is that of a feature staircase created for a house on the Hudson River in New York State. In this contemporary residence, a large entrance lobby area called for a magnificent staircase to connect the ground and first floors. The brief was that the stairs would also provide access to both left and right-hand first-floor balconies. Its shape needed to incorporate, complement and enhance the profile of the existing



curved wall, so creating the 'contemporary-classic' look the clients were after.

The solution was a staircase made of stainless steel, with a retro twist in the form of a grand curved balustrade. The dramatic balustrade, of satin-polished stainless steel bars following the curvature of the stairs and landings, was inspired by the railings and the overall grandeur of the 1920s cruise liners crossing the ocean between England and America, in the days before air travel became the norm.

For the treads, instead of the usual materials such as marble or stone that are traditionally used, DuPont Corian was selected for its tactile qualities, warmth and also for its colour since being a manmade material it doesn't have the striations or patina found in natural stone and can therefore achieve the unblemished, brilliant pure white that the design called for.

The treads are supported by a satin-polished stainless steel box spine down the central main flight, whilst the flights to the right and left galleries are cantilevered from the wall. Elongated upright fixings were designed to minimise the cantilevered bulkhead of the landings and are an integral part of the balustrade with bright polished elements at the top and bottom. For a finishing touch, at the foot of the main staircase feature newels plunge down into the floor to give the design an organic feel.

On descending the central staircase the occupants are met with a magnificent vista of the open forest through windows that stretch from floor to ceiling. The staircase's lightness of design and its pure understated materials help maximise the view's impact.

□ Bisca
United Kingdom
☎ +44 (0)1439 771702
www.bisca.co.uk



Flowing curves

When independent oil company Tullow Oil relocated its offices to a new 132,000 sq.ft space in Chiswick Park, London, a design scheme was planned that would not only reflect the company brand but would also embrace the ethos that 'people come before bricks and mortar'. This human-friendly fit-out includes carefully laid out workstations, staff health and recreational facilities, meeting rooms and an elegant reception area with sensuously curved panelling formed from DuPont Corian.

The new head office is by Peldon Rose, a design company which specialises in office design, refurbishment, relocation, furniture specification and installation, project management and maintenance of all workplace mechanical and electrical services.

Strong architectural elements characterise the design. A key motif is the seismic data that the oil company specialises in collecting and analysing. According to designer Cara Rodrigues, "The design philosophy behind the new space was to create an exciting workspace and an energetic, flowing environment with emphasis on Tullow Oil's global relationships. There was also a strong focus on environmentally sustainable materials and products." The outcome is dramatic, sweeping waves of Corian in Glacier White colour giving a sleek, pristine freshness. Thermoformed and seamlessly joined to create this monolithic impression, it has also been milled in strips and then backlit to exploit its translucency. Corian is said to have offered many properties required for this project as its versatility can be adapted to suit advanced fabrication techniques, and it also performs in application to the highest standards, the company claims.

□ DuPont Corian
United Kingdom
☎ +44 (0)1296 663 555
www.corian.co.uk

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Statement chair

The Flock Bubble Chair, an illuminated, suspended chair by bespoke design company Rousseau Design, has now been made available in the United Kingdom. Ideal for use as a statement piece the chair is suitable for residential projects. It was first commissioned by the Lighting Design Collective of Madrid for a private nightclub in Azerbaijan, and the striking, illuminated bubble chair features a sophisticated etched flock pattern and utilises 7 m of DMX-controlled RGB LED lighting in a static single colour. In the nightclub, the colour change lighting system synchronises four of these chairs.

Designed to hang from the ceiling, the chair is described as combining strength with femininity, and juxtaposes a polished ring of stainless steel and soft faux-fur cushions. The elegant motifs were originally designed to complement the custom-illuminated panelling specially created for the nightclub, but can work equally well in a domestic setting. In addition, a variety of custom-made models of the chair can be created; a collaboration with street artist INSA resulted in a cheeky fetish-inspired design of high heels, legs and buttocks that wittily suited its curvy shape.

The London-based design studio specialises in bespoke lighting, product design and high-end interiors. Its signature style is a combination of high-tech materials and treatments combined with a twist of lighting detail. The products are designed and developed by Ben Rousseau and all are currently manufactured and made to order in the UK. Design and manufacturing solutions are undertaken for a wide range of private and commercial clients including architects, galleries, marketing agencies and brands.

□ Rousseau Design Ltd
United Kingdom
☎ +44 (0)20 7953 1259
www.rousseau.co.uk



Add light and colour for decor with drama

Pietre Preziose by Okite is a new translucent surfacing material designed to create a stunning luminous ambience when backlit, bringing a sense of drama to spaces such as hotel reception areas, bars, nightclubs and washrooms. Okite surfaces are composed of around 93% quartz and 7% polyester resin and were initially conceived for use as kitchen worktops. The material then evolved into other interiors applications, such as bathrooms, flooring and walls suitable for the home, but is also suitable for contract use on treads and risers, as floor tiles, cladding and partition walls.

Available in slabs measuring 3,060 x 1,400 mm, with thicknesses of 13, 20 and 30 mm, used for horizontal and vertical applications, it can also be customised to fit any project. The non-porous surface is hygienic, and claimed to be much more resistant to cracking, staining or breaking than many quarried stones. For kitchen use, the material will also withstand limited exposure to normal cooking temperatures. No special care or maintenance is required.

As shown here, the material allows the light flowing through to create a warm and sophisticated environment, and give the look of natural onyx without the problems such

as staining, fragility and inconsistency often associated with this stone. Unique design, fine materials and innovative transparency are claimed as the hallmarks of this collection. It is also available in a choice of thicknesses and can be cut and edged to suit each individual project for a bespoke finish. Its polished surface can be wiped clean to look as good as new.

Each of the collections is designed to fulfil both decorative and specific design needs for commercial, institutional and residential applications, with a wide variety of colours and surface textures making this surfacing material a practical choice for all spectrums of the design industry. The company states that, from production to installation, particular attention is paid to the environment and this strong commitment to minimising impact on the planet is at the heart of the process: from the use of quartz derived from sustainable and high-quality resourcing, to recycled glass, to the most efficient use of natural materials and to the sustainable production chain.

□ Okite
United Kingdom
☎ +44 (0)1992 470 801
www.okite.com



VIP privacy

Moveable partitions company, Style, has provided flexible space in both the VIP and dining areas at the new Grosvenor G Casino Didsbury located in the Parris Wood Entertainment Centre, Didsbury.

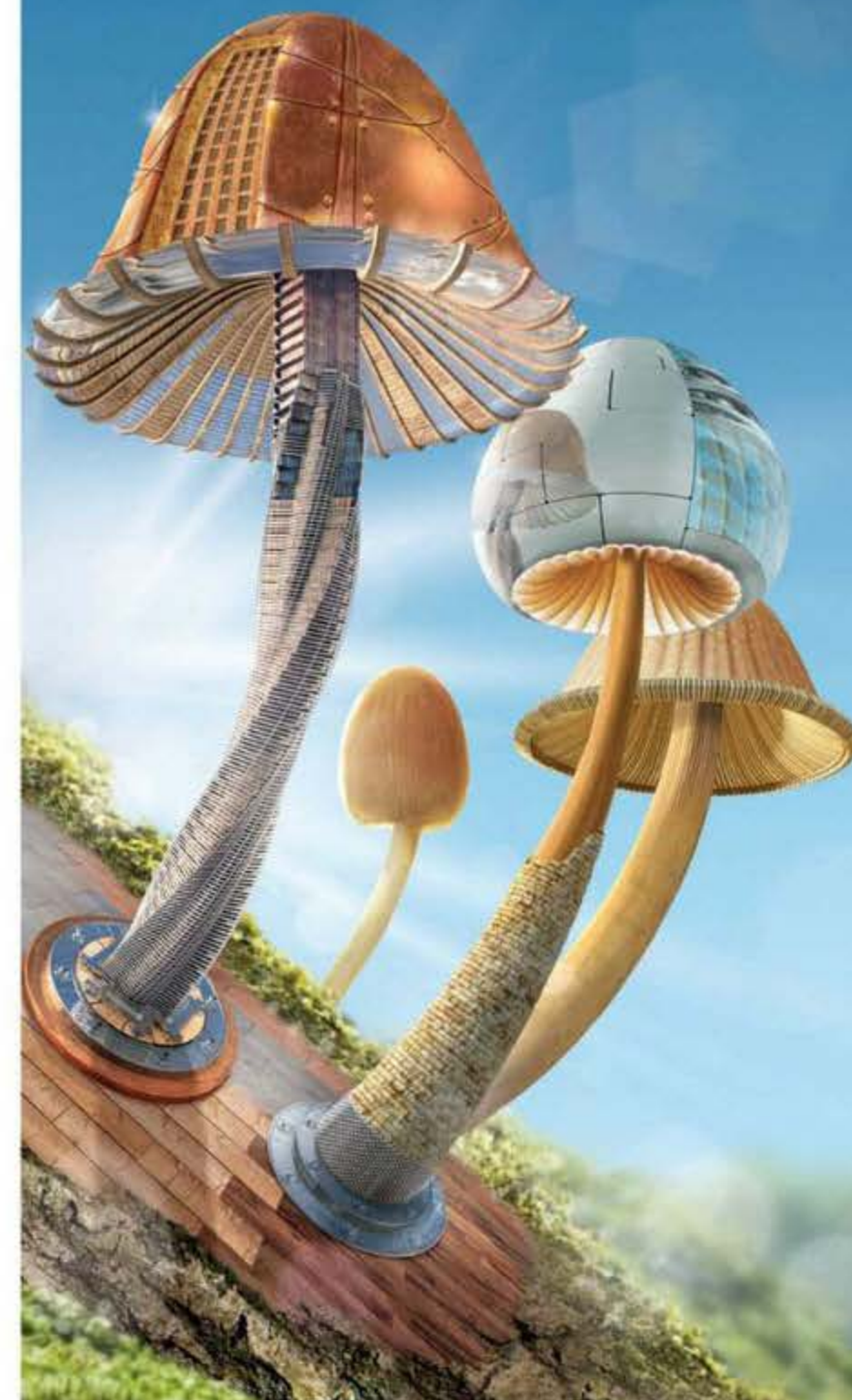
A key aspect of the installation was to offer a solution that could sub-divide space with ease, offering privacy to guests and diners whilst also complementing the chic styling of the Casino.

A Dorma Varitrans partitioning system was chosen for the VIP area. This all-glass system provides exclusive privacy yet maximises unbroken vision and sight lines creating an inspirational interior. Simple manoeuvring of the panels allows staff to quickly reconfigure the space to accommodate different groups as required. A spring has been housed in the floor under the full height pass door, delivering ease of use and greater control. The Dorma Variflex partitioning system was also selected for the dining areas, finished with an American walnut veneer to blend harmoniously with the interior. Delivering an acoustic rating of 45dB(A) the partitions effectively minimise noise disturbance from elsewhere in the room.

"The photographs of this project speak for themselves," said Andy Gibson, Style's director for the North. "The entire Casino looks absolutely stunning, and we were extremely pleased with how our moveable partitioning walls complemented the interior design whilst also offering flexibility of space, privacy and quiet."

□ Style South
United Kingdom
☎ +44 (0)120 287 044
www.style-partitions.co.uk

□ Dorma UK Ltd
United Kingdom
☎ +44 (0)1462 477 600
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BAU 2013 Preview



BAU 2013 in Munich – The Fair for Architecture and Energie 2.0

BAU 2013 will take place in Munich from 14 to 19 January 2013. The world's leading trade fair for architecture, materials and systems will showcase the solutions and products of more than 2000 exhibitors from 40 countries on 180,000 m² of hall space and 3500 m² of open area. The four main themes of the exhibition will be sustainability, age-appropriate construction, Energy 2.0 and urban development in the 21st century.

Two years ago, over 235,000 visitors attended BAU 2011. In 2013 the organizers hope to break this record again. Austria, Switzerland and Italy account for the largest number of overseas exhibitors and visitors, and in 2011 there were significant increases in visitor numbers from almost all the top 15 countries. Particularly noticeable were the strong rises from countries like Turkey and Russia. The globalization of the building and construction industry – and hence of BAU – is reflected in the growth in visitor numbers from non-European countries. 8,500 visitors came to BAU 2011 from outside Europe. 3,505 travelled from Asia, including 854 from China. Exhibitor numbers also reached a new alltime high in 2011, with 2,058 exhibitors from 46 countries. The proportion of exhibitors from outside

Germany was higher than ever, at 26%. BAU 2013 will have four key themes: Sustainability, Building for Life, Energy 2.0 and Urban Development in the 21st Century. Sustainability has now become a generic term for contemporary, responsible building, and products and materials fulfilling sustainability criteria will be on display at the booths of most exhibitors at BAU. Sustainable building and planning are also key event themes in the supporting programme.

Buildings for life, i.e. buildings that suit all generations, is an idea that is gaining ground in Germany and Europe. It requires living space to be designed and fitted out in such a way that there is room for everyone, so that all occupants feel a sense of well-being and security, whether they are young, old, large or small. BAU 2013 will include several events focusing on this theme.

In Europe, around 40% of the energy consumed goes on heating buildings. Energy efficiency has therefore long been a key theme in construction and is also the focus of Energy 2.0. At BAU, lectures and special shows will be held looking at how buildings and urban districts can be supplied with energy in the future and which technological innovations are likely to emerge.

Already today half of us live in cities. By 2050, 75% of what will then be a global population of around 9.3 billion people will live in urban areas. Urban development in the 21st century will be a major challenge with regard to infrastructure, mobility, security and energy supply.

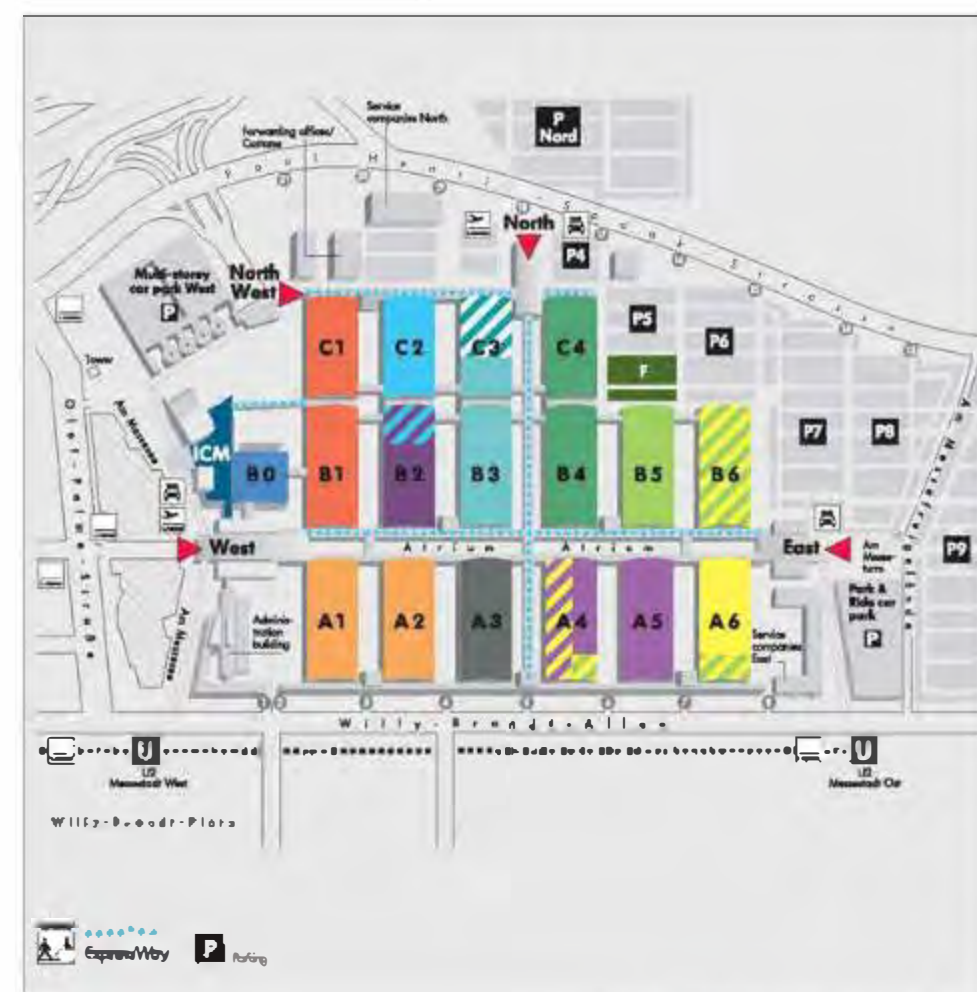
BAU 2013 will include 17 exhibition halls covering a total area of 180,000 m². The halls will be arranged according to construction material, product and theme. What makes BAU special is the fact that it brings together under one roof all the technologies, products and materials used in planning and construction.

This cross-functionality makes BAU a good information source for everyone involved in planning and building: from investors, planners and architects through to skilled tradesmen and facility managers. BAU is also a platform for showcasing new products. Exhibitors gear their new product development to the BAU cycle and new product innovations, such as windows, doors, floor coverings and new facade elements, are presented in this term.

Traditionally halls at BAU have been divided up into categories according to product or material type. For BAU 2013, however, this established system of organization is being overlaid with an additional orientation system, with exhibitors also able to be found under a specific theme heading.

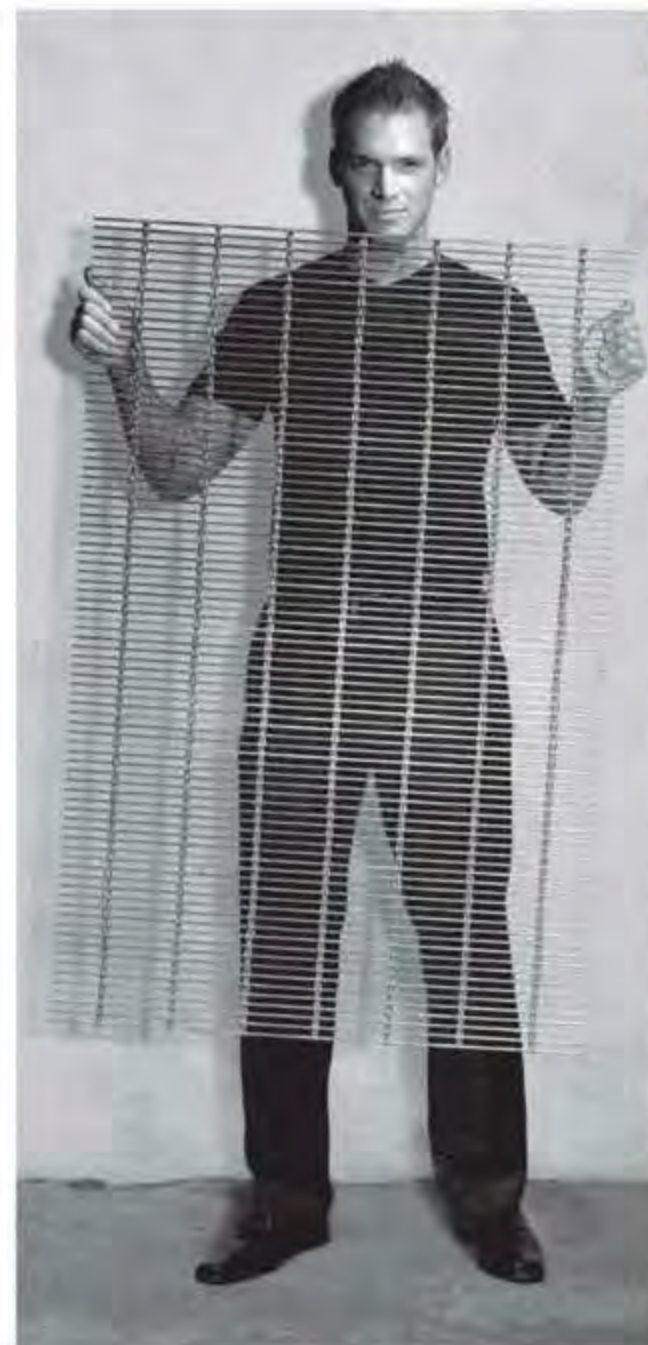
BAU is also a very important information and communication platform for planners, architects and construction engineers from all over the world. In 2011 BAU was attended by over 50,000 visitors working for architecture and planning firms. In six years, the percentage of planners among the visitors to BAU has doubled.

□ www.bau-muenchen.com
□ www.messe-muenchen.com



As of: August 1, 2012 – Subject to change and modification –

- A1** Stones / Soils
 - Stones / soils • Sand-lime brick • Concrete • porous concrete • Pumice / Fibre-reinforced building materials
 - Facade systems • Dry interior finishing • Prefabricated building • Plasters • Screed
 - Insulating materials
- A3** Bricks / Roof building
 - Bricks • Roof tiles • Roof-building materials • Dormer windows • Facade systems
 - Energy-generation systems • Chimney-building materials
- A4** Stone / Cast stone / Outdoor design
 - Stone • Cast stone • Facade systems • Floor coverings • Garden and landscape architecture
- A5** Chemical building products / Construction tools
 - Plasters / varnishes / paints • Adhesives • Protection against heat, cold, fire and noise
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 - Accessories
- B1** Investing in the future
 - Renovation & modernisation • Research and grants • Institutes / associations / service companies
- B2** Aluminum: blades / Tools for aluminium and steel work
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- B3** Steel / Stainless Steel / Zinc / Copper
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- C1** Wood / Plastics
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Forums and special shows to cover key themes at BAU 2013

In addition to booth presentations by exhibitors, forums and special shows will also be held at BAU to cover and illustrate the trade fair's key themes. BAU is organizing these in close collaboration with highly regarded partners.

Urban Intelligence: "Tomorrow Town"

Increasing urbanization, a changing climate, the energy turnaround, dwindling resources and demographic change are all big issues facing the world today. Cities and local authorities have a key role to play in meeting these 21st century challenges. In its special show (Hall C2, Booth 135), the Fraunhofer Building Innovation Alliance will present product and system solutions for a liveable, sustainable and future-capable "Tomorrow-Town".

Universal Design: Particular challenges for building components

Universal design is a concept aimed at ensuring products are designed and manufactured so that they can be easily used by the largest-possible number of people. Trends such as demographic change are bringing universal design into the spotlight in the building industry. In designing houses, rooms and building components, it is becoming ever more important to ensure that these are easy to use and flexible. This special show, which BAU is organizing in cooperation with ift Rosenheim, illustrates using product examples the specific implications universal design will have for building components such as windows, doors and gates. The show will take place in Hall A4 on an area of around 200 m².

Building for life: Cost-effective, flexible and convenient

This special show, held in cooperation with the GGT (Deutsche Gesellschaft für Geronototechnik - German Association for Gerontechnology) in Hall A4, will be all about how to design buildings and products for all generations, and what products and materials

are required for this. The display focus this time will be on comfort. On around 200 square meters of space in Hall A4, a show apartment will be constructed, with full-scale, multifunctional and flexible rooms fitted out with products that suit young and old alike.

DGNB Special Show: Sustainable building products.

In its special show, the DGNB (German Sustainable Building Council) will be giving architects and planners decision tools they can use when choosing sustainable building products. Using examples of completed and certified projects, the display will illustrate the relevance of building products for the construction, operation and certification of sustainable buildings. It will also exhibit specific solutions that illustrate the effect of building products on building performance and the certification result.

Forum B0: Pushing back borders

Forum B0 will concentrate on the big themes for the construction sector.

- Sustainability and dwindling resources
- Energy generation and energy-efficiency in Germany, Europe and the world
- Intelligent networking of buildings
- Demographic change and universal design.

Because these major themes can be viewed and analyzed from a number of different angles, we are working with three partners in this forum: The German Federal Ministry of Transport, Building and Urban Development, the Fraunhofer Building Innovation Alliance, and the Bundesarbeitskreis Altbauerneuerung (BAKA), a working group on renovation and modernization. Another focus in this forum is the modernization and renovation of buildings. In the lectures given by the Bundesarbeitskreis Altbauerneuerung (BAKA, a working group on renovation and modernization), attention will focus on how to improve existing buildings to meet the challenges of the future.

Forum Hall A6, Part 1: "World-spanning, solutions-oriented"

This forum in Hall A6 will look at the role of the architect now and in the future. In Part 1, which BAU is organizing in cooperation with the architecture journal AIT, several themes will be covered – each relevant to architects around the world and of fundamental interest to the building industry.

The keywords are:

- transcontinental cultural change in architecture
- worldwide climate change and the response in architecture
- globalization in the architecture of medical facilities
- international sports events and national architectural competence
- trends in the architecture of office blocks around the world.

Forum Hall A6, Part 2: "Integrated, interdisciplinary, visionary"

"DETAIL research" is a contacts platform run by the architectural journal DETAIL. It focuses on development issues and scenarios on the future of building. Architects and other professionals from industry, university research and politics exchange views in the DETAIL research network. DETAIL collects, structures, assesses and communicates these results on a cross-media basis. At BAU a few of the themes in architectural research will be presented by architects, researchers and industry representatives. A trend panel will present an overview of the current status of research.

Forum Hall C2: "The Future of Building"

At the forum entitled "Future of Building", leading planners, architects and construction engineers from around the world will explain, using project examples, the nature of design and construction in the future. Each day this forum will examine the different themes that will have a significant impact on construction in the future.

Supporting Programme

Here are some highlights of the Supporting Programme of BAU 2013:

Archi-World Academy: Internships with top architects

Two years ago, BAU and the Archi-Europe Group launched the world's biggest competition for architecture students: The Archi-World Academy. Architecture students and young architects from around the world were invited to submit energy-saving projects and concepts for the future, with winners being awarded internships with major international architectural practices. The prize ceremony, at which at least some of the VIP jurors will be present, will take place on January 16 at BAU.

Young people train..... for World Skills WorldSkills is the name given to the professional championships for young employees in skilled trades from all over the world. The next international WorldSkills championships will take place in July 2013 in Leipzig. Visitors to BAU can enjoy a preview of the event when the German national construction-industry team consisting of masons, plasterers, tilers and carpenters gathers together at the trade fair in Munich for a public training session.

"The Long Night of Architecture"

Another highlight will be the "Long Night of Architecture", organized for the first time at BAU 2011. In 2013 it will once again be held during BAU on Friday, January 18, with visitors able to visit to the city's most attractive and important buildings. The event is all the more fascinating because it takes place at night. Between 18:30 and midnight, free shuttle buses will operate between the buildings, with passengers able to get on and off at any time. Inside the buses architecture students will provide information on upcoming buildings. In addition to the tours of the buildings, which are open to all, there will also be a number of guided tours with specific focuses as part of the supporting programme for exhibitors and visitors to BAU. These tours will start at the exhibition center, and registration is required in advance. For participants from abroad, there are special group arrangements, with guided tours and explanations in foreign languages. Further information can be found online at: www.lange-nacht-der-architektur.de.

BAU 2013 – which in 2013 will celebrate its 20th anniversary – will take place from 14 to 19 January in the Munich Trade Fair Center.

For further information visit:

- www.bau-muenchen.com
- www.messe-muenchen.de

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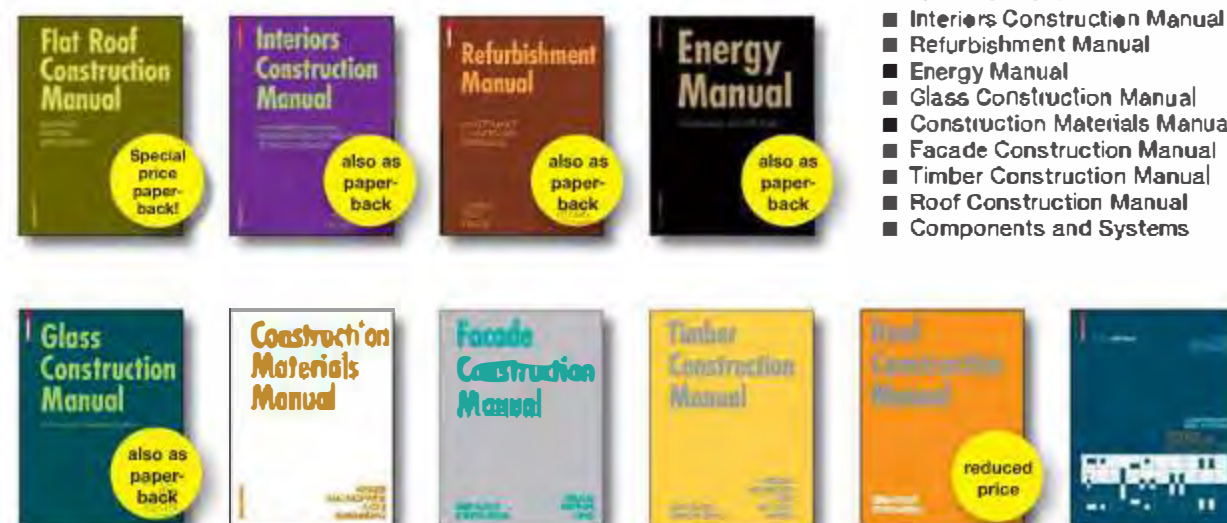
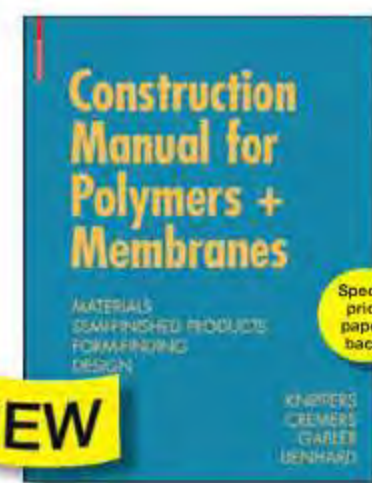
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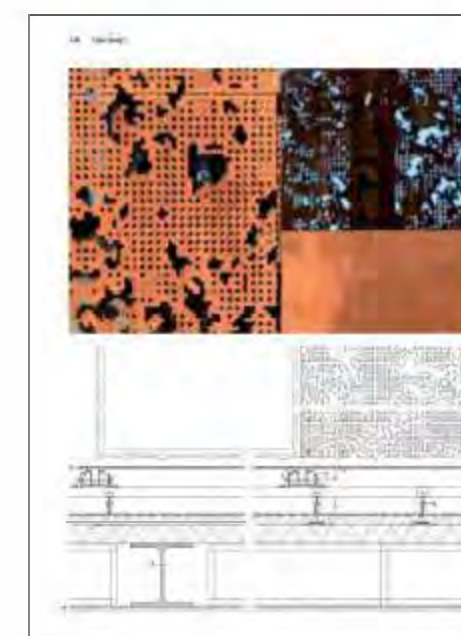


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Temporary Pavilion in Noda

Tokyo University of Science,
Noda Campus, Yamazaki
Noda, Chiba pref., Japan

- Architects:
Kazuhiko Kojima + Kojima Laboratory,
Tokyo University of Science
www.c-and-a-co.jp
- Team:
Kayoko Sakashita, Kumiko Sato,
Bonkun Shin, Yusuke Takizawa,
Takeshi Harikai, Koji Matsushita,
Yuka Mukai, Eiichiro Moriya,
Takuma Yokomae
- Structural engineers:
Jun Sato Structural Engineers, Tokyo,
Japan
<http://sozai.arch.t.u-tokyo.ac.jp/>
- Planning of membrane:
Taiyo Kogyo Co, Japan
(Shigetoshi Nakata, Akihiro Noguchi,
Kenji Hashimoto, Jun Kitamura)
www.taiyokogyo.co.jp
- Lighting design:
Masahide Kakudate Lighting Architect &
Associates, Inc.
(Masahide Kakudate, Junichiro Nozawa)
www.bonbori.com
- Membrane:
Taiyo Kogyo Co., Japan
www.taiyokogyo.co.jp



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Sun Moon Lake Visitors' Centre and
Administrative Building near Yuchi

Zhongshan Road 589,
555 Yuchi Township, Nantou County,
Taiwan

- Client:
Administration of Sun Moon Lake
National Scenic Area
- Architects:
Norihiko Dan and Associates, Tokyo,
Japan
www.dan-n.co.jp
- Team:
Norihiko Dan, Tadashi Yoshimura,
Eiji Sawano, Minghsien Wang,
Masato Shiihashi
- Structural engineers:
Structure Design Group, Tokyo, Japan
www.sdg.jp

Horn Gyun Engineering Consultants Ltd.
Taipei, Taiwan

- Main contractor:
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www.worktech.com
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Taiwan
- Landscape planning:
Norihiko Dan and Associates, Tokyo,
Japan
www.dan-n.co.jp
- Su Mao-Pin Architects



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Artist's Studio on Fogo Island

Fogo Island, Newfoundland, Canada

- Client:
Shorefast Foundation and the Fogo
Island Arts Corporation
- Architects:
Saunders Architecture, Bergen, Norway
www.saunders.no
- Project architect:
Todd Saunders
- Team:
Attila Bérés, Ryan Jørgensen,
Ken Beheim-Schwarzbach, Nick Herder,
Rubén Sáez López, Soliz Bernard,
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Dave Torraville
- Mechanical services, electrical
planning:
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- Construction:
Shorefast Foundation, Fogo Island,
Canada
www.shorefast.org
- Solar module:
Solar World, Camarillo, USA
www.solarworld-usa.com
- Windows, doors:
Thomas Glass, St. John's
Tel.: +1 709 7220234



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4700 Vennesla, 4701 Vennesla, Norway

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Municipality of Vennesla
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Helen & Hard, Stavanger, Norway
www.hha.no
- Team:
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www.hha.no
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Moelven Gtuelam, Moelv, Norway
www.moelven.no
- Gluelam walls:
KLH, Hønefoss, Norway
www.klh.no
- All interiors, ceilings, ribs, furniture:
HMI, Kristiansand, Norway
www.hmi.no



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Tram Depot in Berne

Bollgenstrasse 58
3000 Berne, Switzerland

- Client:
Bernemobil, Berne, Switzerland
- Architects, construction management,
structural engineers:
Penzel Valier AG, Zurich, Switzerland
www.penzel.ch
- Team:
Ralf Gaitmann, Gino Grotti, Claudia
Loewe, Nikolaus Lohri, Christian Penzel,

Tim Schäfer, Roland Schmedt, Roland
Siegel, Martin Valier, Stephanie Weiss,
Laura Zraggen

- Representation of the owner:
TGF + Partner, Zurich
- Mechanical services:
Pgmm Schweiz AG, Winterthur,
Switzerland
www.pgmm.ch
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Switzerland
www.hkggroup.ch
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Bernemobil
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AFC Air Flow Consulting, Zurich
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www.bakus.ch
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Lamberts GmbH und Co, KG,
Wunsiedel, Germany
www.lamberts.info
- Rail engineering installation:
Maschinsky & Krause, Görlitz, Germany
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Strabag AG, Cologne, Germany
www.strabag.de
- Steel construction depot,
metal construction:
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Emmen, Switzerland
www.josefmeyer.ch
- Double glazing:
MLG Metallbau, Bern, Switzerland
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MEVO-Fenster AG, Reinach, Switzerland
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Hodapp GmbH & Co. KG, Achern,
Germany
www.hodapp.de
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Scherrer Metec AG, Zurich, Switzerland
www.scherrer.biz
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ARGE Elektro Bernemobil
Gfeller Elektro AG,
Hinterkappelen, Switzerland
www.gfeller.ch
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Switzerland
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Zimmerli Kühni AG, Ramsel, Switzerland
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Switzerland
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www.zumtobel.ch
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Alpiq Intec West AG, Berne, Switzerland
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www.meierag.com
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SmartFloor Solutions, Baden-Dättwil,
Switzerland
- Wall and floor slabs:
Blatter AG, Berne, Switzerland



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Museum of the Bavarian Kings in
Hohenschwangau

Alpseestrasse 27 a-b
87415 Hohenschwangau, Germany

- Client:
Wittelsbacher Ausgleichsfonds,
Schlosshotel Lisl GmbH & Co. KG
- Architects:
Staab Architects, Berlin, Germany
www.staab-architekten.com
- Project architect:
Hanns Ziegler, Per Köngeter
- Team:
Brigitte Fischer, Daniel Verhösdorck,
Sibel Yilmaz, Sandra Lorenz, Hjordis
Klein, Ulf Theopold, Sebastian
Hafte, Anna Hüper, Christian Stockert,
Johanna Bornkamm, Romina Streffng,
Fatma Wegner, Dominik Schendel, Dirk
Richter, Tobias Steib, Marcus Ebenor,
Manuela Jochheim
- Construction management and
refurbishment:
Rustler Schmid Architects, Friedberg
- Structural engineers:
new building:
IFS Frohloff Staffa Kühn Ecker, Berlin,
Germany
info@fb-berlin.de
- existing building:
Barthel & Maus Beratende
Ingenieure GmbH, Munich, Germany
www.barthelmaus.de
- Mechanical services:
Kuehn Bauer Partner, Munich, Germany
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- Lighting design:
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www.lichtkunstlicht.de
- Building physics:
Müller BBM, Planegg, Germany
www.mbbm.de
- Fire protection:
HHP Berlin, Berlin, Germany
www.hhpberlin.de
- Landscape planning:
realgrün, Munich, Germany
www.realgruenlandschaftsarchitekten.de
- Conservation:
Atelier Gerhard Gingeles, Füssen,
Germany
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Mazzolini GmbH & Co. Bauunternehmen
KG, Füssen, Germany
www.mazzolini.de
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Zimmerli Schneidberger, Füssen,
Germany
www.schneidberger.de
- Steel construction (new building)
Prebeck GmbH, Bogen/Furth, Germany
www.prebeck-stahlbau.de
- Tinsmith:
Max Doser GmbH & Co. KG, Füssen,
Germany
www.max-doser.de
- Metalwork, facade of linking structure:

Steindl Glas GmbH, Kevelaer, Germany
<http://www.steindlglas.com>

- Roofing work:
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www.wittenauer-gmbh.de
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Germany
www.schreinerei-mayr-fuessen.de
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Germany
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STINGL GmbH, Munich, Germany
www.stingl-online.de
- Heating and ventilation:
Max Doser GmbH & Co. KG, Füssen,
Germany
www.max-doser.de



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King's Cross Station in London

King's Cross Station
N1 9AP London, UK

- Client:
Network Rail
- Architects:
John McAslan + Partners, London, UK
John McAslan, Hiro Aso
Simon Goode, Pauline Nee
www.mcaslan.co.uk
- Team:
Mark Bell, Allan Dor,
Louise Hanson, David Jackson,
Dean Kirkwood, Michael Mason,
Aidan Potter, Sascha Stscherleina,
Philippe Vadi, Jasmine Wadla,
Katherine Watts
- Structural engineers:
Western Range and new concourse:
Arup, London, UK
www.arup.com
- Roof and platform refurbishment,
footbridge to station:
Tata Steel Projects, York, UK
www.tatasteeleurope.com
- Mechanical services, electrical

planning:
Arup, London, UK
www.arup.com- Fourways, Wembley, UK
www.fourways.co.uk
- Architect for King's Cross Square:
Stanton Williams, London, UK
www.stantonwilliams.com
- Access consultant:
David Bennett Associates, London, UK
www.davidbennett.co.uk
- Contractor for Eastern Range building:
Laing O'Rourke Costain JV,
Berkshire, UK
www.costain.com
- Contractor for platform refurbishment,
footbridge, service yard, Western Range
and new concourse:
Vinci Construction, Hertfordshire, UK
www.vinciconstruction.co.uk
- Roof refurbishment:
Kier Rail, Bedfordshire, UK
www.kier.co.uk
- Western concourse roof structure and
cladding:
Seate, Gersthofen, Germany
www.seate.com
- Mezzanine building shell:
Swift Horsman, Hertfordshire, UK
www.swifthorsman.co.uk



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National Stadium in Warsaw

Al. Księcia J. Poniatowskiego 1
03-011 Warsaw, Poland

- Client:
National Sports Centre, Warsaw, Poland
- Architects:
gmp – von Gerkan, Marg und Partner
Architects, Berlin, Germany
www.gmp-architekten.de
- with:
JSK Architects Sp. z o.o., Warsaw,
Poland
www.jsk.de
- with:
schlaich bergemann und partner,
Stuttgart, Germany
www.sbg.de
- Project architects:
Markus Pfisterer, Martin Hakiel
- Team, design:
Stefanie Eichelmann, Lars Laubenthal,
Fabiola Rahimi-Nedjat
- Team, execution:
Carsten Borucki, Lena Brögger,
Katarzyna Cirk, Stefanie Eichelmann,
Alberto Franco Flores, Ruthie Gould,
Patrick Klügel, Monika Kwiatkowski,
Lars Laubenthal, Ausias José Labatón
Ortega, Fabiola Rahimi-Nedjat, Nikolai
Reich, Stefan Sass, Florian Schwarhoff,
Sonia Taborda, Semra Ugur
- Structural engineers:
schlaich bergemann und partner,
Stuttgart, Germany
www.sbg.de
- Main contractor-civil engineering:
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www.alpine-bau.de
- Mechanical services:
HTW, Hetzel, Tor-Westen + Partner,
Berlin, Germany
www.htw-ingenieure.de
- Projektów DDMAR, Gdańsk, Poland
- Electrical planning:
PPI Target Group Sp. z o.o.,
Warsaw, Poland
www.ppitargetgroup.eu
- Elektrobudowa, Katowice, Poland
www.elbudowa.com.pl
- Technical installations:
Imtech Polska Sp. z o.o., Warsaw,
Poland
www.imtech.pl
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Protect, Warsaw, Poland
www.protect.pl
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und Gebäudemanagement mbH,
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Munich, Germany
www.bfgest.de
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Squadrat – Gesellschaft für Lichttechnik
und Gebäudemanagement mbH,
Schwanstetten, Germany
www.squadrat.biz
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installation, fire protection system:
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www.bosch-sicherheitssysteme.de
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Paderborn, Germany
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Review of Architecture + Construction Detail

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